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INTRODUCTION.

IN commencing the 5th volume of the "INDIAN FORESTER" it is well to refer back to our prologue of July 1875, and recall some of the circumstances under which the journal was started, noting how far it has, in the four volumes already published, fulfilled the promise it made, or received the support it needed, to keep its place as the representative of Forestry in the Literary and Journalistic world of India.

Our prologue asked for help from all—help in the matter of personal notes and experience—help from those who prefer to write essays, and can constantly contribute either from their experience or from their wide reading—help from the sportsman and the traveller—and help, last of all, from Government, whether Local or Supreme. And this help has been given, and we have every reason to be satisfied that, generally, we have been able to keep going our journal with a majority of original papers. But there are a few points of complaint,—points which may not be entirely known to our Subscribers, and these we may mention.

In the matter of original articles and translations, we have done pretty well, but our contributors are very few. In the matter of notes, short memoranda, and other ordinary communications such as render a journal like ours interesting and useful, we get very little, and in these again the number of our contributors is very small. Of Shikar and Travel we get little or nothing, though many Forest Officers are noted masters in both arts, our principal contributions in these subjects have

been from outsiders. Many a time has a number been constructed with difficulty by the Editor, often long after it should have appeared, simply from want of material to fill it—material which should have been original, but whose place has been filled with extracts from other newspapers and magazines, or with Government reports and publications which have already been circulated officially and read by almost all subscribers.

But, on the whole, we think, we have been successful in maintaining the character of the journal, even in the face of such difficulties as that the Honorary Editor has also had his own work to attend to as well as that of the journal, and that often material for a number has been sadly deficient. The occasional lateness of issue has no doubt been a great drawback to the utility of the "FORESTER." This is now, however, being remedied, and if our constituents will only give us their help, even with the smallest contributions or the roughest notes, we shall, we hope, be able to issue punctually in future.

A few words on the financial position of the "INDIAN FORESTER." The first few volumes were well supported, and were able, in spite of numerous woodcuts, maps, and such expenses, not only to pay their cost, but to leave a margin which has been carried on to meet any chance of future mishaps. Such is not, however, now the case, and the accounts of last year ended with a balance in hand of scarcely 30 rupees. We are, therefore, compelled again to ask for subscribers, to ask our present subscribers to induce their friends to help, and not only to subscribe, but to contribute. It is, we regret to say it, a fact, that a few months ago hardly 30 per cent. of the Forest Officers in India were subscribers; the number of others who receive the paper is naturally small, and we have consequently had for some time to fall back on the amount received from Government for the copies taken officially. Every one will agree that this condition of things is not as it should be, that our principal subscribers, like our principal contributors, should be Forest Officers, and we hope that in making this appeal, we shall succeed in obtaining the support of the department as a whole, and not merely of a few of its members.

HONORARY EDITOR.

The "Chôs" of Hoshiarpur.

By B. H. BADEN-POWELL, C.S.

Conservator of Forests, Punjab.

Conservator's visit DURING the last official year the Commissioner of the Jullundur Division called my attention to the inquiries that had been instituted by Mr. Coldstream, the Deputy Commissioner of Hoshiarpur, regarding the ever-increasing damage done by the torrents or "chôs," which flow from the outer range of hills in the Hoshiarpur District. I promised to visit the district in the autumn, and accomplished this purpose in November last. I entered the district at Rûpar, and at once proceeded for some miles along the road which runs parallel to the range of hills at a distance of 4 to 6 miles, my object being first to see how these "chôs" affected the country at some distance from their source.

Outline of tour. 2. Having seen the same phenomena repeated again and again, as I crossed sandy bed after sandy bed, I left the road, followed the course of a "chô" from Kâtgarh up to its source, and thus having reached the hill tract, I pursued my march sometimes among the lower hills and sometimes at the foot of them, making excursions in various directions and crossing and re-crossing the range so as to see both sides of it, till I had traversed the whole range from one end to the other.

Preliminary remarks on the condition of the range. 3. I have thus been able to form a pretty good idea of the formation and present condition of the range itself, and of these "chôs" or sandy-bedded torrents which flow from it. Before entering on a descriptive account, or suggesting any remedial measures, a few preliminary remarks have to be made.

4. It was my wish to have prepared a joint report with Mr. Coldstream, but he thought better to submit his report from a revenue and general point of view separately; this he has done, and has favored me with a copy.

5. I can only here permit myself one remark on the revenue aspect of the question, and that is, that at a time when taxation is becoming necessary to meet our heavy and possibly recurring famine expenditure, it seems to me a very important point in our economy that, while trying to raise new revenues, we should not endanger our existing sources of income, and especially that we should not neglect means (if means there are) by which lands, now barren and yearly extending in area as regards non-productiveness, may be restored to a condition of fruitfulness and so be able to pay revenue.

6. In one tahsîl alone Mr. Coldstream says they calculate 35,000 acres of land covered with sand by "chôs;" it should not be forgotten that in this rich and well-peopled district, this land alone, if reclaimed, might be on our rent rolls bringing in a yearly revenue of at least Rs. 50,000.

7. Under any circumstances the preventative treatment of these "chôs," even if it did not result in the reclamation of land, would at least result in a cessation of yearly loss of revenue, which the continued action of these floods must entail.

8. In order to convince the Government of the magnitude of the evil we propose to attack, *facts* of the first importance. The most convincing fact would be a comparison of the accurately ascertained area under sand in the years of the old settlement, and the area *now* under sand as ascertained by a present survey; but this comparison is obviously unattainable at present. It probably will be so at the next settlement, and I fear that re-assessment will then convince the most



A "CHO" OR SAND TORRENT AS SEEN ABOVE THE VILLAGE OF CHOHAL, DISTRICT HOSHIARPUR.

sceptical what a powerful agent for mischief these "chôs" are.

I submit, however, that though this is wanting, there is amply sufficient evidence to warrant Government taking action in the matter.

A systematic inquiry has been made, and the almost universal result has been that the villagers have everywhere asserted either positive loss or else the deterioration of their land. The same complaints were as universally made to me whenever I met the people on my way, although they did not know who I was, nor had they previous information either of my arrival or of the purpose of my visit. Indeed, it only needed a local inspection to convince oneself that what was said was in great measure true.

Mr. Coldstream has adduced distinct instances where it is on record that particular tracts were not affected by the "chôs" at Mr. Melville's settlement, which now are more or less ruined by their action.

9. Of course the result is not accomplished in a day.

Cautions against being misled by the slow progress of the mischief.

Owing to peculiarities to be noticed hereafter, the action of many of the "chôs" is more gradual than that of mountain torrents properly so called. But no one with the smallest powers of observation can follow the course of almost any one of these "chôs" from the place where it debouches from the low hills downwards, without seeing unmistakable proofs of the damage, which cannot stop itself, and must in the nature of things grow gradually worse and worse.

10. It is also quite an idle objection to urge that these

Argument that the "chôs" have always been there.

"chôs" have *always been* a feature of the Hoshiarpur District, and that it is hopeless to contend with them. Many evils, which are ultimately successfully combated, remained for years in operation before any one thought of taking notice of them; and if it is only now that we have progressed to the study of such questions, it certainly is no argument that such study is useless, or that a remedy is impossible or not to be undertaken.

The evidence that the low hills were once well-wooded is quite complete; there are portions of them still well-wooded enough to show what they all might be, if subjected to proper conservancy; and there, too, it is easy to see how the soil is protected by the natural growth.

11. There are certain peculiar features regarding the hills and the streams flowing from them that require notice.

I have been unable to obtain any geological information regarding them, but their characteristics may be described sufficiently for practical purposes.

The north-east boundary of the district is formed by ranges of Sub-Himalayan hills, most of which are in foreign territory, until we reach Amb, where the British territory extends further inland, over the hilly "tappas" of Darú, Lohára and Panjal.

All these northern hills give rise to numerous stony torrents and ravines.

The Sohán rivers—one flowing north-west and joining the Beas, the other or main one flowing south-east to the Sutlej—flow along at the base of this inner range of hills, and on the south side, at some distance, rise the outer Siwálíks, the special object of my visit. The whole of this broad Sohán Valley, part of which forms the Jaswan Dhún, is subject to torrent action, stones being the chief feature rather than sand; and the valley is cut up, not only by the torrents from the northern range, but also by those on the other side of the Sohán, coming from the north-east slopes of the outer range.

12. I find that the people about Amb speak of this outer range (as they look at it across the river) as the "Katár Dhár," but the people on the Hoshiárpur side and the villages actually in the range do not appear to have any general name for it.

13. Thus the geography of Hoshiárpur for the purpose of this report is simply described: an inner barrier or series of hills forming the

north-east limit of the district, then the broad stony valley of the Sohán, then the outer Siwálík running parallel to the Sohán, all through the length of the district, (about 80 miles from the Sutlej to the Beas) and below the outer range again, the plains of Hoshiárpur, fertile and wealthy, but intersected by the dreary stretches of sand which the streams leave during the dry months of the year.

14. To the northern side of the Sohán Valley it is impossible to apply any remarks at present. Most of the hills are out of our control, and of course the torrents will continue to increase, spreading out their great fan-shaped beds of deposit and creeping on to swell the vast stony bed of the Sohán, which is almost dry for a great part of the year.

Remarks do not apply to the Sohán or valley to the north of the outer range.

Where the British boundary does extend, the forests in Darúi, Lohára, and Panjal "tappas" have been fairly well preserved. The forest is of extremely poor chíl (*P. longifolia*) on a sterile sandstone extremely hard as soil, but not perfectly formed as stone. A dense growth is hardly to be looked for. Though grazing is strictly and really excluded from all the reserved forest, the progress is very slow; seedlings are rare, and any undergrowth only occasional. It is impossible to spend any money on artificial cultivation, and we can only hope to secure a gradual amelioration of the soil by the deposit of vegetable mould in the course of years.

Forests on this side, wherever in British territory, are fairly preserved, but of inferior character.

15. On the north boundary of Hoshiárpur then there is not much to be done; but it is on both slopes of the outer range that interference is most urgently called for, and specially on the south-west face, because it is from this face that the "chôs" descend, intersecting and destroying the fertile plain lands of the district, and carrying their destructive agency far down even into the Jullundur District, as the Commissioner has recently informed me. This range we can attack

The outer range calls for attention.

without much difficulty, and with a certainty of ultimate success.

I propose then to give a general description of the outer Siwālik range, and of the torrents which flow from either side of it.

16. The whole range consists at present of a highly irregular and confused mass of fantastic cliffs, points, and slopes, the result of the gradual dissolution and detrition (by the tropical rain-fall) of the up-heaved beds of sand, clay, and pebble conglomerate, of which the hills consist. It attains no great elevation.

General description of the range.

Its elevation.

The highest points on the atlas sheets are :—

Baraol station (Sutlej end)	... 1,582 feet.
Maidwani station	... 1,943 "
Pandú station	... 2,220 "
Munji "	... 1,878 "
Pamráh "	... 2,047 "
Koti station (just where the range divides into two spurs at the Beas end)	2,198 "
A station near Tung	... 2,430 "

17. Towards the Sutlej the range is comparatively narrow, with a well-defined crest or central line of greatest elevation. But beyond the point whence the Nasári Ghát (Pass) crosses, the range widens out, and the centre is occupied by the almost level table-land around Manuswál, locally called the "Bít" of Manuswál. This consists of a stiff loam, which no doubt formed an extensive deposit capping the other strata; it has gradually been levelled by water action, but still numerous points and miniature cliffs are left standing not yet washed down by the rain. The fields are also in several cases again being eroded towards the edges, and deep hollow water-courses formed.

The Bít.

The fact that this level plain is due to a deposit of stiff loam is clearly seen by the sections as one passes down from the Rána's garden near Manuswál to Mehidpur, which is just below the hills on their north side.

A curious feature of the "Bî" is the total absence of wells. The people are dependent on large ponds locally called "toba," which are partly naturally, partly artificially, dug out in the stiff clay and banked up; whenever, as in the rainy season of 1877, the rain-supply fails, the water diminishes, and what remains becomes thick and dirty. This must, I think, be productive of disease among the people who are obliged to use it having nothing else.

18. Beyond this again, the range continues at an average breadth of 8 to 10 miles, but with a
Description of range. generally well-defined high line or crest of very fantastic shape and indentation, having equally irregular side spurs separated by torrent beds, which in most cases form the "chôs" of Hoshiarpur. At the extreme Beas end of the range the crest forms into two distinct branches separated by a broad stony torrent-bed. It is on the north-east arm that the Karanpur bamboo forest is and on the south-west that of Bindraban.

19. The range consists entirely of vast beds of sand, alternating with loams or clays in much
Materials of which the range is formed. smaller proportion, and extensive beds of loose conglomerate or gravel. The pebbles of the latter are never very small, nor are very large boulders found; they vary from the size of a pigeon's egg to twice the size of a large ostrich egg, but not as a rule bigger; they consist of metamorphic and quartzitic gneiss and granite rocks, derived from the older Himalayan formations.

That these beds are all the result of aqueous action there
Deposition and upheaval. can be no doubt; but the strata so deposited have been upheaved, and distinct lines of dip can be traced in many places; a good example is near Pamráh, where distinct stratification and a dip at about 30° to south-west is observable.

20. The strata are, as a rule, extremely soft; the consequence has been that the whole bed has
Soft texture. been cut into by the rain; and as the pebble beds naturally resisted longer than the sand, and as

the sand has only in places (of this more hereafter) been hardened or compacted, there is every conceivable variety of fantastic shape communicated to the hills throughout.

At first, near the Sutlej, there is nothing but sand so soft as to be easily cut with a knife, and occasional layers of clay. The Sutlej has cut a clear section through this, leaving an abrupt cliff or face, which, however, is continually breaking away, as the river undermines it. But very soon the conglomerate appears, and bare pebble-covered slopes become common. As a rule, there are more stony slopes on the north side, but there is very considerable variety throughout.

21. The sand next demands our attention. By far the greater bulk of the strata of sand are soft and ill compacted, their deposit having been too recent or too little subjected to geologic pressure to have been hardened into stone.

Nevertheless there are extensive strata, of what may be called stone, chiefly towards the centre of the range, such strata varying from the very soft and brittle but distinctly laminated grey-stone, of which I found a specimen close to Chohál (in going from that place to Gagrét across the range), to the real hard building stones occurring in very considerable masses of a grey colour (and closely resembling in appearance such sandstone as we find below Murree and Dharmśála), which are met with further on the same Pass beyond Pamráh.

The beds of this hard sandstone often enclose small rounded pebbles of older rock; their structure seems to be simply sand with some mica in it, agglomerated by lime; for though I could not make a regular analysis, it was easy by the action of the diluted acid on the pounded stone to separate it into fine loose sand and a quantity of lime (deposited in the test tube in the form of a sulphate). Indeed, throughout this range, lime plays an important part. Besides the formation, by its aid, of these beds of stone, almost everywhere traces of the infiltration of lime (dis-

solved by the acid of the rain water, &c., and afterwards deposited) appear.

22. This infiltration of lime results (1) in the formation of narrow tubes or pipes of lime deposit, which traverse the soft sandstone and fill up all crevices. Often no doubt long fibrous roots have helped the formation, having become incrustated with lime and then decayed; (2) in belts of irregular, nodular and stalactitic-looking stone which may frequently be observed exposed and projecting beyond the soft sandstone which the rain has washed away.

Such belts of stone often form a barrier across the beds of small torrent feeders. Pieces of the same Nodular lime concrete, material, nodular and irregular like "kan-kar," may be picked up on the sand everywhere in the "chô" beds.

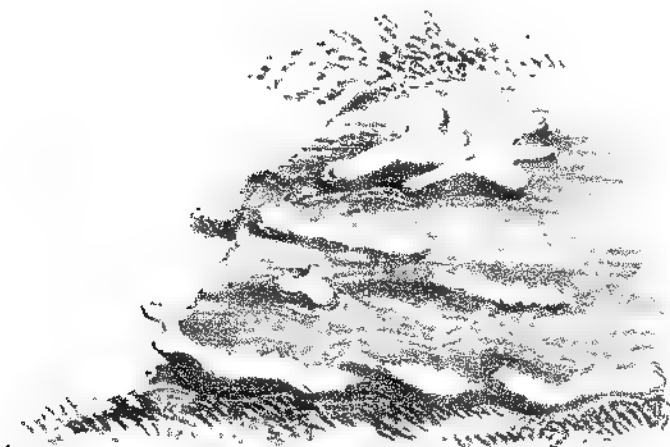
23. On the north side of the range, and notably towards Mehidpûr, below Manuswâl, there are large beds of calcareous "tufa" alternating with gravel and clay. This is so nearly a pure limestone that it is extensively burnt for lime. The hard belts and nodules of stone first alluded to are not pure lime. In some cases they are of coarse sand cemented by lime, which when dissolved out by acid, leaves the grains of sand free; in others they are of a more compact granular-crystalline texture. Acid dissolves these, yielding lime sulphate and a large amount of argillaceous matter and a little fine sand.

24. Where the lime comes from it is impossible for me to say; but this feature of lime tubes on the sand and of concrete nodules and belts is too constant to be overlooked. It is seen abundantly where there are extensive road-cuttings in the soft sand, e.g., on the road from Chohâl to Gagrêt; every available crevice is filled with a sort of lime petrification; long fibrous roots (as already said) are covered with lime, and long pieces of brittle "lime tubing" may be collected. In other places the gradual formation of the concretionary belts and nodules may be observed.

This lime deposit is a characteristic feature.

The annexed sketch shows a bit of an exposed bank on the road alluded to:—

Fig 1



25. In another place on the road the intervention of pieces of hardened material of this kind had formed a protection to the sandstone which the rain had washed away all round, but could not touch under cover of the little protecting tablets of stones. The result is, that the cliff stands fantastically cut up by longitudinal furrows, so as to resemble a great stack of organ pipes. This form of water action will be familiar to the readers of Lyell's "Principles of Geology." In one place I found a belt of pale buff-colored *marl*, that is clay with a very large proportion of lime in it. That this lime should have been derived from the decomposition of organic remains seems hardly probable, although I notice that Mr. Lyddeker speaks of Siwálik fossils as often being found at the heart of concretionary boulders, which would appear to be agglomerated round the bone by the aid of lime obtained from its partial decomposition.

26. And here I may take occasion to mention that I came on no place in the range where there is anything like an abundance of organic remains, whether of shells or of mammalia

Scarcity of fossil remains.

in situ; a piece of a bone or of a tooth is occasionally found among the hills or in the bed of a "chô," but that is all.

27. I have given this detail about the lime, because it plays an important part in the structure of these hills; it is valuable for use, and it to some extent helps to form a consolidating agent in resisting the erosion of the slopes. Its presence is also the addition of a fertilizing ingredient to the *detritus*.

28. Such being the general features of the hill range, it may naturally be supposed that the *detritus* of the hill slopes is not unfertile except where pure sand or stones predominate. The sand usually contains a fair admixture of clay and some lime. It is not unusual to notice that the deposit left by a "chô" on its subsidence consists of a thin layer of fine mud (pannah), and if a part of the deposit has been cut through, it will be observed that there is often a succession of thin layers ($\frac{1}{2}$ to $\frac{1}{4}$ inch thick) of sand and clay. In places among the conglomerate beds a vivid brown loam (colored by decomposed iron) may be seen. There is no reason to suppose that even the bare slopes where the surface is now covered with pebbles only, would not produce in time at least a growth of brushwood. As it is, nothing gets a chance. Everywhere overcutting, followed by the cropping down of every shoot that has attempted to push forth, may be observed.

29. The plants which are commonest in these hills may now be mentioned. I was surprised not to see the *Dodonæa viscosa*, so abundant in other low, dry hills; but there may be a little at the extreme Beas end. There was, however, plenty across the Sohán not far from Amb. Bushes of "kikar," "phuláhi," "bér" (*Zizyphus nummularia*) and "billan" (*Zanthoxylon alatum*) were common. Kúri (*Nyctanthes arbor-tristis*), *Feronia Elephantum* and *Cassia Fistula* were occasional, and there is plenty of Basuti (*Adhatoda Vasica*). On the higher parts I found kinnu (*Diospyros*), but very gnarled and ill-grown; and in places chil, but scattered and of very poor growth.

"Garna" (*Carissa diffusa*) is also abundant. *Flacourtia sapida* is also common, and "chilla," *Casuaria tomentosa*, occasional, with "rajain" (a tree unknown to me). But so great has been the destruction that one may march for miles and miles with nothing in view, but bare mud-colored crests and

Aspect of the country. rugged slopes, rarely dotted with greyish browsed-down bushes, while an occasional

"kikar" bush that has sprung up out of reach is alone green and flourishing. Herds of hungry goats reaching up for the last living twigs of the ill-used stumps of trees, may everywhere be seen. Nothing is more striking than the general bare, pale-brown or dust-coloured aspect of the landscape for miles together in these hills.

30. Almost the only place I saw anything like a fair growth still surviving, and not cut away and eaten

Exceptions showing what the growth might be. down to the ground, was in descending towards Jaijon by the pass of that name.

There I found a considerable tract, green and pleasant to the eye; the protecting influence of the bushes, in preventing the erosion of the soil, was palpable to the most superficial observation. A certain amount of herbage, an essential agent in soil preservation, was observed, consisting of grasses and flourishing beds of the weed *Cleome pentaphylla*. I would here refer to Mr.

Evidence of former forest. Coldstream's report for detailed evidence how different the condition of these hills once was. But evidence is hardly needed, for the villagers on the spot have witnessed the process of denudation under their own eyes.

I must also leave it to Mr. Coldstream's report to describe

Destruction by villagers. how there are villagers on these hills whose chief occupation is to cut firewood,

and how strings of men, women and children, with loads on their heads, may be seen early in the morning filing along the sandy "chôs" whose dry beds serve so often as most uncomfortable roads. These persons supply the larger towns in the plains, such as Dosua, Hoshiarpur, Hurriana, Garshankar, &c.

31. Not only so, but there are many charcoal-burners working on a most pernicious system of taking their payment by a percentage on the value of the charcoal produced. I myself saw a splendid banyan tree (*Ficus indica*), which must have been the growth of a hundred years, being chopped into billets ; the whole tree had been bought as it stood, I think, for three rupees.

32. The fact is that as wealth increased, the population of the towns increased also, and with it the demand for firewood ; and as the supply has been hitherto no one's business but that of improvident villagers, it has been conducted regardless of all conservancy, as was of course to be expected ; for how should the peasantry know better ? The scarcer the brushwood becomes the wider is the area over which the destroying troops are scattered to search for it. Then the soil around deteriorates from erosion of the unprotected surface, and agriculture becomes more troublesome than cattle-keeping ; so cattle (and goats especially) increase, and all hope for the hills is at an end. Such is merely the natural consequence of non-interference. It is merely a repetition of the history of the Devoluy, of the hills of Savoy, of the Ardèche basin, and many other places.

Such being a general account of the outer range of the Hoshiarpur hills, it is now necessary to describe (but briefly) some of the most noticeable features of the "chôs" themselves.

33. In the first place they are not "torrents" in the technical sense of the word as applied by Snarell. A "torrent" has always a fall of not less than 6 in 100. The result of this declivity is a peculiar formation called the *cone de dejection*, a fan-shaped mass of *detritus*, which forms at the mouth. This also leads to the other special feature of torrents, which is, that when the water comes down, it is discharged along the top of a convex bed, not in a hollow, and as it cannot continue in this situation, the stream must necessarily divide and pour off on this side and that, in any direction which is easiest. These streams

Charcoal-burners.

How the evil progresses.

Cattle cannot increase if there is no herbage to feed on.

Character of the "chôs."

flowing off in all directions, continue depositing more and more *detritus* and spreading wider the fan-shaped mass of *débris*.

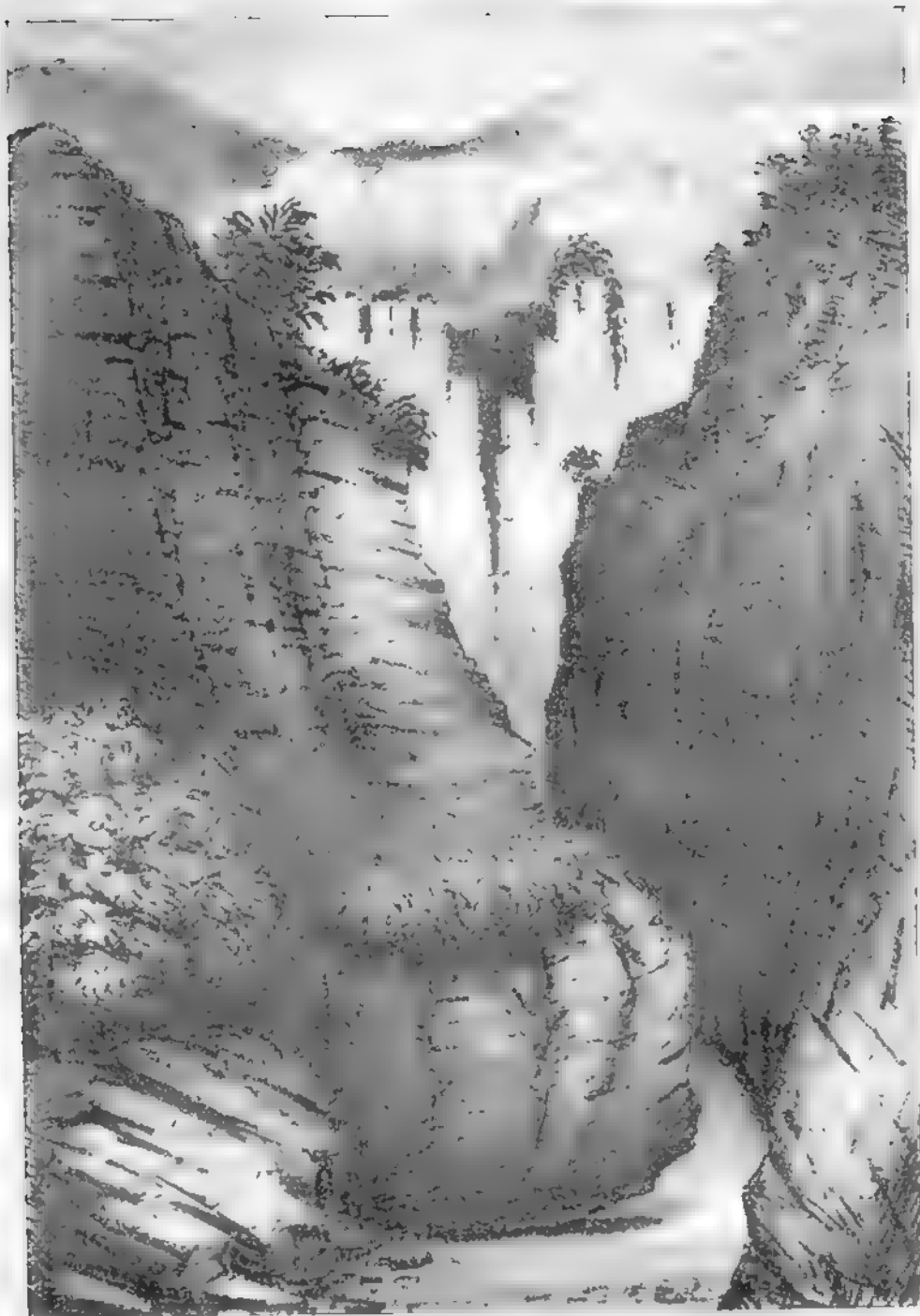
34. But the "chôs" of Hoshiarpur have nothing like this fall. Mr. Coldstream was kind enough to have the levels taken for me of the "chô" which comes past Bhadi (Garshankar tahsil), and the bed of which (for part of the way) is the high road to Nurpur. For about $2\frac{1}{2}$ miles or more up to near one of the main sources, levels were taken showing a fall of about 50 feet in the mile, or less than 1 in 100. The lowest level was taken at the mouth; but it would have required an expert on the spot to select further sites to show how though the *cone de dejection* is greatly reduced in curve and extended in breadth, it is still traceable.

And there is no doubt that this sample fairly represents, within small limits of variation, all the "chôs" on the south side of the range.

35. This comparatively small fall is due to the extreme instability of the material of which the hill is composed.

One of the most instructive excursions I made was to follow into the final ramification of one of its branches the "chô," which is clearly enough shown in the atlas sheet as flowing past the village of Mahli (Mublee in the map). I had halted for a time in the sandy bed of the "chô," near a well, by the aid of whose moisture several trees were flourishing.* Here I was not far from the very outskirts of the lowest spurs of the hill range. I naturally expected, before reaching the head of any one of the numerous branches into which the "chôs" usually split towards the source, to do a certain amount of climbing, or at any rate to find a sort of basin or sloping hollow down which the rain-water would pour in the first instance, at some considerable distance above the level of the "chô." On the

* I have often observed these wells close by the side of "chôs" in places where the bed is wide and near the point of debouchment. In high floods such wells must be temporarily engulfed.



THE BASIN OR SOURCE OF ONE BRANCH OF THE MAHLI "CHO."

contrary, the rise was hardly perceptible ; but to my astonishment, I continued to pass between almost vertical cliffs of sand, so soft that I could dig my nails into it, and traversed by occasional belts of the hardened concrete I have before alluded to. These walls continued getting narrower and narrower, till I could with difficulty squeeze between ; but still only at the bottom was there a channel for the water. At last through a narrow gorge I could see a sort of amphitheatre or cauldron, forming the source of the whole. Above it, no doubt, a convenient basin in the hills had formed a *focus* for collecting the rain-fall which had then crevassed the earth ; the outer wall soon fell away, and left an edge over which the water fell, cutting it away, and eating out the bottom, just as what is called a "moulin" does on a glacier. This was enlarged till the water found an outlet, and then commenced hollowing out a passage between the hills ; the extreme softness of the strata enabled it rapidly to find its way to the lowest level, and hence there was no part of its course where there was any great descent. While this is generally the case with the main line of the "chô," I do not mean to say that it is always the case with the side-feeders. I noticed many instances where streams did descend rapid slopes, and accumulated cones of *débris* at the base ; but wherever this was the case, the water was so rapidly eating through the soft sandstone, that very soon the stream would be at its lowest level between two walls of sand like the one I have described. There are also many smaller torrents falling over the harder conglomerate strata, where cones of stones are formed in true torrent style.

The origin of the torrent stream, above described, will be made clearer by the sketch, from which may be seen the hill amphitheatre which collected the water, the edge over which it then fell, acquiring velocity enough to cut away the soil below, and the outlet by which it ultimately escaped.

36. It is also necessary to remark on the method in which the vast mass of sand carried down by these "chôs" is supplied. In the first place, the general surface of the hills is

How sand which the "chôs" carry down is collected.

cut away, resulting in the abrupt and scarped appearance so well seen on crossing the Sutlej from Rûpar. The *débris* of this is either accumulated in secondary ridges, so often observed at a short distance from the main range, or is absorbed into the current of a gradually-formed water-course. The rain-water as it flows towards the main lines of "chô" drainage is thus already charged with fine sand and mud, carried off from the surface abrasion of the hills, and thus it is already prepared to furnish a considerable amount of depositable material to the "chô."

37. But the bulk of the supply is furnished by the giving way of the scarped surfaces of sand strata, which have been cut through by the stream, and now form its confining walls.

The stream at first cuts *under* the edge of the wall, so that the section would be as in the figure:—

Fig 2



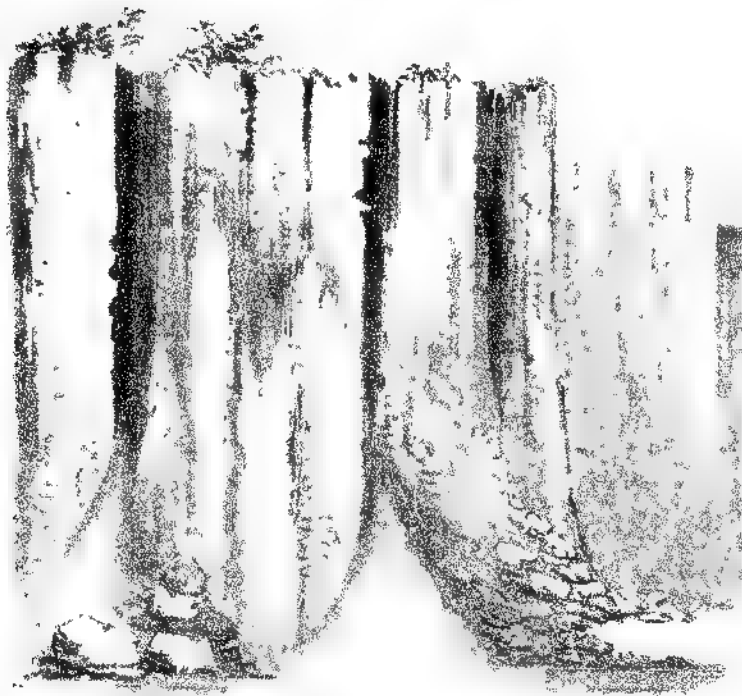
Under-cutting of the walls.

The masses above soon become top-heavy, and fall down leaving a new sharp face exposed. But the water from above,

falling over the edge, soon reduces this, and a series of cones, or one long sloping bank of *débris*, is made, skirting the wall. This bank is easily washed away when the "chô" rises, and then the under-cutting process is resumed.

38. Here is a sketch taken near Badhi, which illustrates what I have said.

Fig 3



Sample of the erosion of sandy banks.

39. Where the high wall of the khud as in the well-known Kiri khud (near Mehidpur on the north side of the range below Manuswâl) has alternate strata of sand, conglomerate, and material hardened by lime, these hard strata resist, and the sand exhibits a series of slopes rebutted or stayed up by the walls below.

40. To resume briefly the features characteristic of the
Resumé. "chôs," the comparatively slight fall of
 the beds depends chiefly on the extremely
 soft nature of the strata, enabling the water very rapidly
 to cut through the soft soil rather than flow over the surface
 or down a channel only partly hollowed out, at a considerable
 angle.

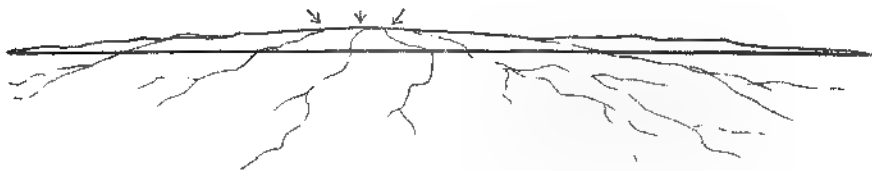
It has also the result of depriving the "chô" to some extent
 of the characteristics of true torrents. The chief of these is the
 absence of any *elevated* or highly convex cone or fan-shaped
 mass of *débris* at the mouth of the channel, and the absence of
 that fixed part of the mountain torrent called *canal d'écoulement*.
 There is probably no part of the bank of these "chôs" that is
 not unstable, and the mass of sand carried down is so light that
 it does not accumulate except slightly at the mouth. But it
does accumulate, though in a very slightly convex and corre-
 spondingly *broad* fan-shaped cone of dejection at the point where
 the "chô" leaves the hills.

41. Where the "chô" has come almost entirely from con-
 glomerate strata, the heap of stones is very
Case of stony "chôs," as compared with the sandy ones. much more perceptible; but even in the
 stony "chôs" the fall is very gradual,
 because, though the stones are hard enough, the strata as a
 whole disintegrate readily enough so as to enable the water to
 reach its lowest level. The only difference is, that in the
 one case the "chô" bed is full of stones, in the other it is full
 of sand.

42. Still the heaping up of material at the point of exit is
 quite sufficient to produce the destructive
The heaping up of material at the mouth causes the spread of the "chô." feature of all torrent action, *viz.*, that the
 water discharged from the channel com-
 ing down on to the top of this heap cannot flow along in one
 straight course, but must fall off on either side in a thousand
 rivulets according to the line of greatest declivity: hence the
 water is divided into a series of streamlets, which in a very high
 flood spread into a broad fan-shape, and cut away on this side
 or on that, according as the obstacles on the ground tend to

deflect the current this way or that. When the flood lessens, the water once more separates into diverging channels, one going this way, the other that. It is hardly necessary to introduce a simple diagram to show how the water discharged on to a bed of accumulating material having ever so slight a convex form must disperse.

Fig 4



43. As, moreover, the mass of deposited materials is very soft, the position of what I may still call the *cone de dejection* constantly varies; for gradually a series of channels are cut into it, and when that is the case, the sand is cut away to be deposited further down.

It is perhaps to this that are due the low mounds to be seen conspicuously near Badhi, at some distance from the foot of the hills, and which have been again cut through by the water.

44. The only rule which is constant is, that the deposit must occur according to the weight of the material.

The water coming with great force bears along with it mud, sand and stones. Where stones are few, they are deposited before they have gone any distance, then the sand, and lastly the mud, which goes furthest of all. Two forces are at work—first the decrease of velocity (as the fall lessens) gradually depriving the water of the power of carrying on the mechanically suspended matter, and then the fact that the light sandy sub-soil absorbs the water. It would follow from this that the fine mud would be carried furthest and would form a deposit of fertile soil, but the sand being largely in excess, one year's

deposit of mud is covered with the sand of the next flood; and above all during the dry hot months, the sand is lifted by the hot winds and spread over the surface.

45. This is one of the great sources of damage. If it were only water action the sand would be deposited and the water absorbed, and the danger would be very great from the constantly increasing supply of sand; but we have to add to this the effect of the wind, which blows the dry sand about, burying fertile lands and raising great mounds which continually encroach on the fields.

46. How far the water travels depends on the length of duration and abundance of the rain-flood; but all the "chôs" in the winter and summer are perfectly dry except in the north of the district (*e.g.*, coming from Harriana to the Sadr Station), where a slender stream of sluggish water is more or less perennial.

47. The result is the aspect of the landscape that has been alluded to. Going along the main road and consequently the mischief spreads. that traverses the district from south-east to north-west at a distance of about 4 to 6 miles from the foot of the hills, we find that the road is perpetually cut across and the fields intersected by beds of dry hot sand, often half-a-mile and more in breadth, and these keep extending in *breadth*, owing to the action of the wind and water; and in *length*, as each heavier flood carries its sandy deposit further plain-wards, till at last not only the whole area of the rich plains of Hoshiarpur is affected, but the mischief extends to Rahun and the Jullundur District beyond.

48. The way is now prepared to consider what can be done, if anything, to effect the double object of preventing the further extension both in length and breadth of the "chôs," and of reclaiming the land which is, or has been, rendered unculturable by sand. And Remedial measures possible. We have to prevent the further extension, and reclaim the injured lands. I may here remark that there are vast areas of land which are not wholly unculturable, but are nevertheless so far injured by a sandy deposit as to yield nothing but a wretched

spring crop of "bherra," or gram and barley sown together in varying proportions according to the degree of badness of the soil. But rarely is a second crop (and that a poor one) obtained; whereas these lands ought to be "do-fasti," and capable of producing the finest sugar-cane and other valuable and paying crops.

49. The remedies obviously consist of two main works—(1) the control of the water discharge at its source; and (2) the confinement and straightening of the course of the water when it debouches on to the plains.

50. The first remedy can never be overlooked. Before the effect of forest growth in retaining the soil on hill slopes and furnishing a power, which (a) diminished the violence with which the falling rain struck the soil, (b) absorbed a portion, causing the rest to flow off without violence, and (c) filtered the water so as to let it run off clear,*—before this power was investigated and generally understood, engineering skill alone was called on to deal with the *lower part or course* of the torrents, to dig out a straight bed, to construct dykes, or erect powerful side dams.

51. But the works always failed, and for obvious reasons. As long as the water at the sources was uncontrolled, its power was usually on the increase, and consequently either the works had to be constructed of such enormous cost and solidity as to resist in anticipation the largest possible flood, or, being for economy's sake constructed of only sufficient strength to resist what was called "any ordinary flood," the moment a flood occurred (which is sure to happen) so heavy "that the oldest inhabitant could not recollect the like"—away went the works and the money spent on them.

52. Now, in all modern works in the Alps, the sources are attacked first, and then when some degree of control has been obtained,

* This is a matter of great importance. It is never to be forgotten that the water of torrents does not effect the mischief as clear water, but as water whose laws are altered by its becoming viscid, owing to the mud and sand in suspension.

engineering works are called in and are successful to protect roads, bridges, &c., lower down.

I cannot lengthen this report by giving instances, but I beg that reference may here be made to the account of the treatment of the torrent of St. Marthe near Embrun (an affluent of the Durance) at page 362, and again at page 376 of the "FORESTER" for April 1877 (Volume II, No. 4.)

But in attacking the sources of the evil, two preliminary objections must be disposed of. First it may be said that the greater part of the hills consist, as we have seen, either of soft unformed sandstone, or rather of beds of compacted sand, or else of beds of clay and uncemented conglomerates. These we have described as presenting, owing to past and presently continuing action of the rain-fall, a series of scarped faces, points and peaks, mostly bare of vegetation and only clothed with little grass and a few sparse and browsed-down bushes; these points *must* be washed

down, and the steep banks that have no solidity *must* give way, for in many cases they are so steep that nothing will grow on them.

To this I reply that the *gradual* levelling down or sloping off of such rugged surfaces is undoubtedly not only unavoidable, but to be desired; but that while it is going on it will be possible to modify the rate and the violence with which it is effected, and above all, to prevent the land-slopes, into which the material invariably forms itself when it falls down, from being removed by subsequent floods.

The sand as it lies in the hills is far from being unsuited for bushes and herbs and grass to grow on. There it is mixed with clay and lime and *detritus* of the conglomerates. It is the sand that has been cleaned and separated by water action and then dried up and spread by the winds that is unfertile.

And the very fact that the scarped walls which have been alluded to are so soft that, as I have said, the finger nails can be dug into them, renders it exceedingly easy for roots to strike into them; and examples are not wanting to show how

Two objections to the practicability of control.

The first question.

Reply to it.

Then the sand scarps can be covered with vegetation.

easily even a nearly perpendicular wall of such material, can be clothed with vegetation, which soon covers and protects, not only the sharp edges which are subject to the erosive action above described, but also the slope of gradually formed debris at the base.

52½. The second objection is, what proof have you that these bare hills, which as you say present to the eye long desolate lines of irregular crests of a glaring dust color only relieved by rare specks of green, are the remnants of often cut and browsed jungles?

I have partly replied to this in saying that the soil, however reduced, is not unfertile, at all events as regards a growth of bushes and grass, which are better than nothing, and will prepare the way for a better growth to follow. But besides this there is ample evidence that these hills were once covered with dense growth, and that enormous supplies of firewood have been cut off them. Some parts have still growth enough left to show what the great bulk of the area might be restored to.

53. How far the whole work could be done by nature, and how far planting must be called in, cannot be determined by one tour. This much is, however, certain; that taking the data of previous growth, and the natural fertility of the soil into consideration, where there is a fair rainfall, protection and natural restoration will effect a very great deal. Now the annual average rainfall nowhere is less than 30 inches. In Hoshiárpur it is (on an average for the last ten years) 31·4 inches, at Dosua 35·8, at Garshankár 34·8, and at Unah in the valley beyond the outer Siwálíks, 37·9 inches. Besides this, *if experience shows it is desirable to plant, the same steps will have to be taken as a first measure in either case.* Hence there is no room for reasonable doubt as to what ought to be done.

54. The interests to be considered are—(1) the supply of firewood and the grazing requirements of the neighbouring villages. The former is not very pressing; there is so little wood left that in a very short time the supply will be stopped

Aid of artificial sowing, &c., may be needed;

but protection alone will do a great deal.

Rainfall.

How to dispose of the rights and interests if the work of protection were commenced.

by natural causes, so that it can be very little hardship to stop it now, and *rigidly to confine permits to cut to places where there is really material in a fit state to cut.* As to the grazing, that can be provided for. The extent of it is, it should be borne in mind, one of the indirect results of ill-treatment of the forest. The more the invasion of sand spoils the land, the more there will be a tendency among the people to become less agricultural and more pastoral. Cattle, especially goats (the worst enemies of the forest) and camels,* increase, and as the soil gets barer and poorer, the forage-supply falls off, grass gets scantier and more wiry in growth; and the consequence is this, that the cattle are spread over a larger and larger area to seek their food, and the mischief increases till it reaches a climax.

55. By preserving portions of the forest, the grass supply will improve, a smaller area will then suffice to support a larger number of cattle; that will be an effect which will make itself felt in a very short time, and is of such chief importance that it is hardly necessary to allude to the more remote benefit, that as facilities for agriculture return, cattle not required for farm purposes will gradually diminish.

56. These preliminary objections being met, I would propose at once to demarcate from the crest (which is usually well defined) as far down both sides as circumstances will allow. Where there is a table-land the slopes on either side will be taken, leaving the table-land clear for cultivation. In addition to this, the slopes flanking certain "chôs" will have to be taken along their course through the hills, and in all cases the demarcation line must be so arranged as to include the "perimeter" or catchment area of all the head-waters of the chief "chôs."

57. All attempts to break up lands for cultivation, and all firing, must be stopped in this area. Wood-cutting must be restricted to the places where material still exists *fit* for cutting. The cutting

* That is, those cattle increase which are not kept for the plough, but for the profit of their use as beasts of burden or for the sale of their milk, those cheapest fed and kept being preferred: hence the abundance of goats and camels.

of all *trees*, especially ber and peepul, in the area must be prohibited under heavy penalties. And, lastly, selected areas in the general line must be declared closed against grazing. Thus a general provision will be made for the whole tract to be a "protected forest" under the new forest law and subject to the above restrictions.

58. But with a view to providing for grazing, which as I said is the chief difficulty, there must be
 Essential feature to provide for a system of "ghasnis."
 and partly within the protected area, and partly without it, of establishing what in Simla are called *ghasnis* and in Kangra *kharitars*, or grass preserves, which are to be assigned to villages or groups of villages, and to be managed by the people themselves just as they are in Simla or Kangra. During the season of grass growth the grazing of cattle is strictly interdicted. When the grass crop is ripe it is cut and distributed, and then cattle are allowed in for a certain time, till the season of growth comes round. Firing is never allowed, nor must such bushes as spring up (but they are not as a rule numerous in any *ghasni* I have ever seen) be cut.

These grass preserves will not only supply the villages, but themselves help in protecting the soil.

59. All this can be effected either under the new law (as
 The new forest law amply sufficient;
 nothing can be clearer than that this area can be closed on account of its protective character and its influence on the protection of land from shifting sands, action of torrents, &c.), or it can be effected
 or the Rules of 1855, which are law.
 under the "Rules for the Hill District of the Punjab, 1855," which have the force of law under the Punjab Laws Act, and which provide as follows :—

"Section I. In any hill district, within British jurisdiction, the civil authorities may mark off *any* tract, plot, or ground, wheresoever situated, which they may consider to be specially adapted for the growth of timber or fuel."

Sections II., III., and IV. provide for fencing and prohibition of trespass, &c., in the tract.

And Section VI. provides :—

"No person shall be entitled to object to the foregoing rules, whether relating to enclosures or to particular species of trees, shrub, or brush-wood, on the score of proprietary or manorial right, provided always that the civil authorities do not interfere with the wood or fuel that may be really required by the occupants or owners of the land for agricultural or domestic purposes."

Section VII. "With the proviso above described, the civil authorities within the said hill district may prohibit, restrict, or regulate any operation which they consider calculated to destroy or injure existing supplies of timber or fuel."

It will be observed that no reservation is made in favor of rights or privileges of any outsiders, *i.e.*, of any but owners or occupants of the land reserved.

These rules will not be repealed by the new law.

It is immaterial, it will be observed under this law, who *owns* the land; the only condition is that certain reasonable wants are provided for.

60. But besides this general protection of an area in the outer range, it will be necessary to take some more decided steps for direct reboisement work in the actual catchment areas of some of the "chôs." At first I recommend this to be of an experimental character. I should select two or three "chôs" at different points, and demarcating closely the area round the heads of the sources, I should carry out such works as are usually connected with reboisement, *viz.*, the artificial levelling of places, the stopping up by hurdles, or fascines on the *Jourdan* method (*vide* "FORESTER" for April 1877, Volume II. No. 4), or by rough "barrages" of other material, the smaller basins which feed the "chôs," the planting of slopes so formed by sowings or cuttings of *Vitex* (Banna or Sham-bálu) and other species, the protection of surfaces by fascines, or, as in Sind, by rough cheap matting pegged down. The cutting of water-channels to divert the rainfall from accumu-

Direct reboisement works at the sources of the "chôs."

Indication of cheap and simple works which may be carried out.

lating in one rush, and carrying at gentle angles along the sides of slopes which are thus moistened and rendered fit for sowing or natural growth of shrubs and herbage, is also one of the works to be done.

61. These matters can only be indicated in a general way: the application of one or the other, or all, must depend on the requirements of the sites selected for trial works. But in such soft soil they will be neither costly nor difficult.

62. If the sources of one "chô" could be attacked with success only, the result would necessarily be such as to render the pursuit of the work on a more extended scale beyond all question.

63. It may here be necessary to remark that in these works the people are incompetent to act except in the way of respecting the restrictions and co-operating in the supply of labour, &c. They cannot do the demarcation, still less the works of actual protection. To suppose that any system of voluntary conservancy or protection without a demarcation, or such a system of working as I have sketched, would be carried out, is wholly vain and chimerical. Nobody knows this better than the people themselves. It should be the business of all, and that (as Mr. Coldstream remarks) is the business of no one.

64. Such being the work in the hills themselves and at the sources of the "chôs," it remains to be seen what can be done below, both in confining the beds of the torrents, and in reclaiming the land already injured.

I have already alluded to the fact that there is a point depending on fall and configuration of the land where at the debouchure of a stream the bed or series of channels spreads out into a fan. From this point, the sandy bed either forms one vast expanse, or there are several diverging channels with small tracts of land between, which are, however, liable to be engulfed by the uniting of the streams during the heavy flood.

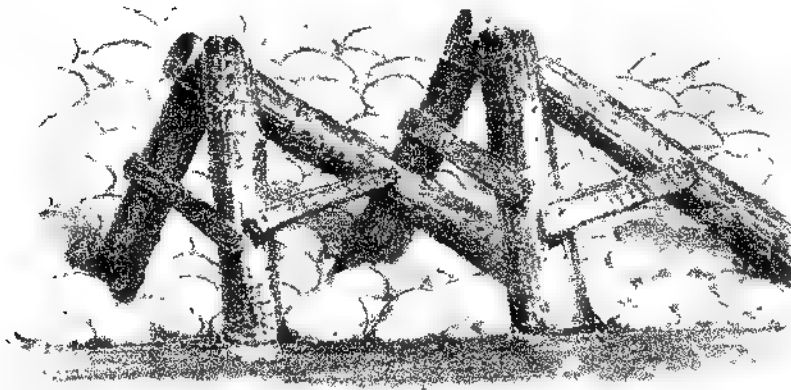
65. It is at these points that works may be carried out.

Points whence the spreading out commences. There are also other points lower down, as where the stream cuts through a secondary deposit of mounds when the same sort of work may be repeated. But in all such attempts one great fact has constantly to be borne in mind, viz., that as long as the floods continue from above with increasing violence, and as long as the mass of material brought down is (in consequence) not diminished, such works are only successful to a very limited extent, as will presently be noticed. *Therefore the attack on the slopes, crests, and torrent sources is the first and fundamental work.*

66. But supposing *that* advanced up to a certain stage of success so that its influence is perceivable below, then the object is to get the stream to cut out a deep bed, and to keep it as straight or as gently sinuous as possible.

Artificial excavation may be resorted to; but taking advantage of all stable soils and planting them, and then protecting the edge with strong hurdles and fascines, also the planting of living spurs or diagonal belts at suitable points down the stream, are the chief reliable means. Besides hurdles, spurs as used in Switzerland, made of poles and filled in with stones, may be utilized.

Fig 5



67. The materials for planting are fortunately not wanting.

Materials for planting.

Already in some cases successful plantings have been made, which even if they fail of their object *at present*, either from want of a system of action above, or from being put in the wrong places, at least have shown that certain things will grow, and will affect the flow of the water, induce a deposit of material, and so help to create a bank. They also show how the sandy soil may be rendered culturable.

The chief plants are, among grasses, *Saccharum munja*, *S. spontaneum*, &c. (Munj and Chhúnd); among other plants 'Basuti' (*Adhatoda Vasica*), Banna or Shembálu (*Vitex Negundo*), and the small 'ber' (*Zizyphus nummularia*.)

The best use of these separately or combined has still to be studied.

68. Where the object is to erect a line spur, no doubt a

Line spurs.

series of lines of tall grass with the Banna and Basuti got to grow into a

mass are excellent.

The people at present plant the grass in tufts obtained by dividing the roots; these do not offer a great resistance to the water flow, but induce a deposit of material around the roots, so that a mound or bank is gradually formed.

The sowing of Munj seed, which would soon be productive of a dense mass, is not practised—partly, I suppose, because it does not so soon produce a resisting mass as the transplants.

The grasses have also an excellent effect in keeping back the encroachment of dry sand by the wind.

69. And here I beg to point out that there is no reason why

The mischief done by wind may be prevented in any case.

this branch of work should not be sedulously carried out. Whatever may be done as regards reducing the flow of the water, it is easy to take steps to prevent the sand being carried beyond the limits of the "chô" bed by *wind*, as it now is. Belts of grass and "banna" are excellent for this, and the ber should be also used.

70. "Banna" is excellent; it grows very rapidly and strikes

Value of vitex for planting. from cuttings with remarkable facility.

The value of the ber is not easily overrated. It has a wonderful power of consolidating the soil: it is in my opinion *the* agent for reclaiming sand-spoilt lands. The fruit is sown and the young plant soon comes up and spreads. When once it has taken hold on the soil, a change is perceived. Between the plants, "khabbal" grass (*Cynodon*)—a sure sign of better soil—begins to grow, and often when all around was dry in the early morning the patches covered with ber were observed to be wet with dew. Nor is this all. The leaves of the plant

Fodder supply obtained from the ber.

are a valuable fodder, and extensive planting of it will do a good deal for the support of the village cattle whose grazing might to some extent be prejudiced by closing tracts in the hills.

But when cutting for this purpose is allowed, the ber ought only to be partly cut: it is true that it recovers from the root, but then it is an object to allow *some* of the leaves to fall on the ground and improve the soil.

Another species to be cultivated where possible, is the Dhák (*Butea frondosa*), as its leaves are cut and spread on the fields and seem to be especially suitable to enrich sandy soil.

71. I have not made any special remarks about trees to be planted in the hills, because I have wished to trust a great deal to natural reproduction of the indigenous species.

Species to be grown in the hills themselves.

Whenever artificial sowing and planting are resorted to, the common indigenous species should be kept to for some time to come. The hills are not too high to enable one and all of the plants found in the plains to be grown: there the *vīṭex* or "banna" will furnish an admirable staple for planting up protected slopes with quick growing cuttings.

The only shrub not commonly found in this outer range I would grow is the *Dodonæa viscosa* ("mendru or sanatta" of other districts.) The seed of this is obtained easily in large quantities; it is not eaten by cattle, is very hardy, and grows in the poorest soil. Otherwise I should confine sowings for promoting fuel growth to kīkar and phulahi, both of which do well.

72. It is next absolutely necessary that all these operations should be properly supervised. Nor is it less important that some one should determine *where* there is any growth left from which the villages which Mr. Coldstream's report describes as gaining their livelihood by this trade may be allowed to cut. This would have to be determined by examination on the spot, and in detail.

Nor will any chance supervision do. A trained Forest Officer, whose attention has been directed to the subject of damage by denudation and reboisement is required; the mere appointment of some Sub-Assistant from Roorkee, or some one with the everyday capacities added to the tincture of surveying required from subordinates, will be of no use whatever.

73. I would therefore earnestly press upon Government the necessity of sending a trained Forest Officer to Hoshiarpur to act as Assistant to the Deputy Commissioner. I would suggest that the Home authorities might be asked to select one of those now studying who has a taste for this branch of work and let him have special opportunities of visiting such works as the reboisement near Embrun, which successfully extinguished the torrent of St. Marthe, the reboisement of the Luberon in the Department des Hautes Alpes, that of Karst in Illyria, and other such works.

In the interval which would elapse, the general demarcation could be made without difficulty, and so much progress would be made as would greatly facilitate the work of the Forest Officer when he arrived.

74. That the small cost incurred by allowing the pay of an Assistant Conservator and a reasonable Forest establishment would, in the course of fewer years than many would expect, be repaid, cannot, I think, be doubted.

A reasonable income from grass and fuel might be expected after allowing for the gratuitous supply of right-holders; but the main value would be the cessation of a diminution of receipts from land revenue, and the increased receipts from reclaimed lands.

75. It may be said that as these hills have not been reserved as Government property, the interference of the State to manage them would be on ground of public advantage, and that therefore the whole of the proceeds must be distributed among the village communities who may be supposed to be the owners. But I think it perfectly fair, and certainly legally admissible, that the expenses of management should be realized as a first charge, and if all the proceeds at first starting were so used, it would not be hard on any one. In its present condition the forest can be of the smallest possible use or value to the so-called owners, and as it grows worse and worse it becomes less and less valuable.

As arrangements would be made to meet grazing requirements, it is impossible to conceive in what way it would be a hardship to assume the management of these tracts, or demand a small fee for such produce as they still yield, with a view of paying the establishment, whose sole object is to increase the productiveness of the area at present so valueless, and at the same time to remedy the mischief which its denudation causes to the properties below.

76. In conclusion, I can only wish that to produce a more vivid impression than any writing of mine can, and to raise a plea more powerful than I can express, some of the leading authorities could travel over a few miles of the district of Hoshiarpur.

To see that splendid district yielding a revenue of nearly fourteen lakhs annually, and yet to observe how mile after mile is cut up with the broad dry beds of sand, not only useless, but spreading their desolation further and further with every hot wind and every flood, would certainly argue powerfully that a moderate expenditure to stem such an evil is better than letting the *steady* if small *loss* of revenue that goes on accumulating continually remain unchecked and uncared for, till some day we wake up to find that the evil has slowly extended to a point either beyond our control, or to one that will cost millions to remedy when thousands will now suffice.

The Muga Silk Industry in the Sibsagar District, Assam.

The Soom tree (*Machilus odoratissima*) on which the Muga silkworm is reared, is one of the commonest trees in the Sibsagar District. It is found in almost all soils and situations, but it is especially abundant on low marshy ground, and in such places is exceedingly gregarious. It is not known if this tree is indigenous in the plains of Assam, but it is certain that it was largely cultivated in former times, and it is now firmly established in the district. At the present day, however, it is seldom, if ever, planted, as existing forests are more than what is required, and a large proportion of them remain unutilized.

In those forests which are worked, all the grass and undergrowth is cut, and nothing is left but Soom and Nualu (*Tetranthera monopetala*), which is also used for rearing the silkworm, but which is much less common than the Soom tree. In each patch of forest used a small hut is built on a platform or "chang," and while the worm is on the tree, the owners watch day and night, and are indefatigable in keeping off birds by shouting and shooting at them with bows and pellets of clay. The worm is generally reared three times during the dry season, which begins in October and ends in May.

Nothing is done in the rains, which last from June to the end of September, and during which time most of the Soom forests are under water; the crops during the cold season take longer than when it is warmer. The caterpillars are first put on the trees in October, and take about two months to spin their cocoons; a second batch is put out in December, and requires nearly three months before the cocoons are spun; the last lot are put out in March, and the cocoons are ready in about 40 days. These three crops are called by the Assamese "Koleah," "Jaruah," and "Jethuah," respectively. Occasionally a fourth crop, called "Aharuah," is collected in June.

The worm soon degenerates in the Sibsagar District, and no cocoons are kept after the last crop of the season. Cocoons

for breeding purposes, to replace the old stock, are annually brought from the Kámrúp District lower down the river.

The cocoons (Muga or Huta Kati, Assamese) are kept in large rectangular trays of bamboo work covered with a piece of chick. The pupa (Letta, Assamese) is of a shining dark brown colour, and the sphynx (Sokuri, Assamese) is a beautiful animal with elegantly marked, broad and angular wings of a rich brown colour, measuring 4 inches across between the ends of the wings. The males have small, and the females large, cylindrical bodies. The eggs (Koni, Assamese) have a whitish grey colour, and are as large as a mustard seed. The caterpillars, when first hatched, are of a pale green colour, with brown stripes and velvety black heads; when full grown, they are of a brilliant green colour, and nearly as large as a man's thumb. The cocoons take 15 to 20 days before the sphynx comes out; the females are then selected and tied by their legs to bundles of sticks or reeds (Khorika, Assamese) about 12 inches long with a hook at one end; these are made of common thatching grass taken from the roofs of their houses. The eggs are laid generally the same day, and are kept on the sticks where laid hung up in the houses. When the first caterpillars come out, which generally takes place after 8 days, the sticks are hung up on the Soom trees to strings of cane or bamboo tied round the stems at about 4 or 5 feet from the ground. On these strings are hung as many sticks as can be hooked on, 40 or more, and below them plantain leaves and grass are tied round the stem, to prevent the worms going downwards. Sometimes when the tree can be climbed without great exertion, the sticks are tied on high up near the leaves on the stem or branches, and this is the better plan, as the young caterpillars have then a less distance to travel before reaching their food. The worms attach themselves to the under surface of the Soom leaves, where they are sheltered from sun and rain, and they eat clean through the leaf from the border inwards. After some time the tree is eaten bare, and then, when no more leaves are left, the worms come down of their own accord and are collected on triangular trays of bamboo work, or on small bundles of branches of the Soom tree. The worms are then transferred to fresh trees, and

this is repeated two or three times, or as often as may be necessary. When the caterpillars are ready to spin they come down from the trees, generally at night time, and are collected in heaps at the foot of each tree on the ground which is cleared for this purpose. Over the heap a loosely-tied bundle of branches, with green or dry leaves adhering, is placed; into this the worms creep and are conveyed to the house, and after about three days they are found to have spun their cocoons among the leaves.

The cocoons intended to furnish the best silk are killed, sometimes by exposure to the sun, sometimes by boiling in water. The inside of the cocoon gives the best silk; the outside and the thread obtained from the cocoons from which the sphynx has come out, and which of course cannot be reeled, yields an inferior, more coarse kind of cloth called "Aria." This latter must not be confused with the "Eri" silk, which is produced by a caterpillar fed on the "Era" tree (*Ricinus communis*), and which is reared entirely in the house.

The Muga silkworm is also sometimes fed on the Mezenkuri or Edenkuri tree (*Tetranthera polyantha*), and in this case yields a much more valued thread. A silk called "Pat" is also produced from the Mulberry (*Morus indica*); these worms are reared in houses as elsewhere in India.

Ordinary Muga thread in the raw state sells at from 10 to 12 rupees per seer, Patatgat at 24 rupees and over, and Mezenkuri as high as 40 rupees per seer. The cloths most commonly prepared in the Sibsagar District are "Reahs" and "Mekelahs" for women, and "Suriahs" (or Dhooties) for men; curtains called "Athuahs," and bags called "Tamulor gamusa" for carrying betel-nut are also very commonly made. "Reahs" are about 6 by 12 feet; "Mekelahs" about 3 by 9 feet; "Suriahs" 3 feet 9 inches by 15 or 20 feet long; Athuahs the same width by about 7 feet long; and "Gamusa" about 18 inches by 6 feet long. Mekelahs require about 16 tolas of the best thread or 20 tolas of the thread of ordinary quality to make them, and are sold for about 3 rupees. Suriahs (Dhooties) require from 60 tolas to 1 seer, according to the quality of the thread, and fetch from 10 to 15 rupees.

As regards the profits to be derived from the production of the Muga silk, these are extremely variable and not always very remunerative. But it must be remembered that the silk is prepared solely for home consumption by Assamese ryots who are, in a way, wealthy people, and with whom, although they dislike manual labour, this work is very popular as it requires little exertion, and all the members, young and old, of both sexes of a family can engage in it at odd moments. It is not necessary, therefore, in order that this industry should live, that the profits from it should be large.

The average size of the patches of Soom forest, held on pottah by the head of a family, is about 5 bighas. A bigha of the best Soom forest yields as much as one seer of raw thread or 4,000 cocoons; inferior or scantily stocked forest does not yield more than 12 to 20 tolas of raw thread. This represents a revenue of from 8 to 60 rupees from 5 bighas of land.

Besides the labor of watching and tending the worms, the only outlay required to produce this revenue is 8 annas per bigha, revenue paid to Government; and the price of the cocoons brought from Kámrúp; these sell at from 300 to 700 per rupee, according as they are scarce or abundant; about 500 cocoons are required for breeding purposes per bigha of Soom forest; the total outlay is then about Re. 1-8 per bigha.

The silk crop frequently fails; on an average not more than one year in three is a really good year for silk. In bad years hardly any silk is made in the district. The cause of failure is not accurately known. But as the Assamese really take very little pains to protect the worms from their numerous enemies, and a great many are killed by rain and exposure, it is probable that a little intelligent supervision in the breeding and rearing would, at least, render success more certain.

Much less Muga silk is now produced than in former years, and it is stated that a less area of Soom forest is rented from Government than formerly. The present revenue from Soom forests in the Sibságar District is about Rs. 19,000 annually. Muga silk, properly speaking, is not now in the market; small quantities of it only can occasionally be picked up.

Not many years ago there was no difficulty in procuring several thousand rupees worth of raw thread in the Jorehát bazar; to-day it would be difficult to procure a few hundred rupees worth.

Whether this decline in the production arises from the failure of the silkworm, or should be attributed to the increased wealth and independence, and consequently dislike for manual labor of the Assamese ryots, cannot be confidently asserted. It seems probable, however, that the latter is the principal cause. This increase in the wealth of the Assamese ryots is entirely due to the development of tea cultivation, which has to a great extent replaced that of silk in the Sibságar District. The busy tea factories, surrounded by partially-abandoned Soom plantations, well represent the relative states of the two industries. It is curious to note that the Soom tree is the enemy of its successful rival the tea tree, which promises soon to be as abundantly cultivated as the Soom tree was formerly. The decaying roots of the Soom tree kill the tea bushes in the vicinity of the stump; and hence land stocked with Soom trees is not, as a rule, much prized by tea planters.

In the collection of the above information I have received the assistance of Mr. W. E. D'Arcy, Assistant Conservator of Forests in Assam.

D. B.

Notes on the Experimental Cultivation of the Carob tree in India.

For a period extending over nearly forty years, more or less desultory attempts have been made to introduce the Carob tree (*Ceratonia siliqua*) into India. Within the last few years more systematic and continuous efforts have been made, and large quantities of the seed have been procured from Malta and elsewhere, and distributed throughout India.

Judging by the reports received by the Government of India from time to time, the success attending the experiment has on the whole been but small. The tree is a native, not of a

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Judging by the reports received by the Government of India from time to time, the success attending the experiment has on the whole been but small. The tree is a native, not of a

tropical, but of a temperate climate, with dry summers and cold wet winters. If it succeeds in the north of India and on the highlands of Mysore, that is probably all that can be expected from it in India.

In its native place the tree bears a pod containing a great mass of sweet juicy pulp, and unless this is properly developed it is of no use as fodder for cattle. It is a slow grower, and, apart from its value as fodder, has nothing in itself to recommend it to India. It has fruited at Madras, Bangalore, Lahore, Lucknow, Nagpur and probably elsewhere. Mr. Robertson, of the Sydapet farm, sent in a favourable report on the pods produced on trees in Madras. The fruit on trees at Lucknow was reported on as good, while some at Lahore was inferior, and at Nagpur pods on examination were found to be dry and useless.

The following points, if carefully noted by intending growers of the tree and made public, would afford data for determining in what parts of India it would succeed:—(a) Date of sowing the seed; under what circumstances; date of germination; growth in seed-beds; proportion of seedlings to seed sown: (b) Date and method of transplanting; soil into which tree was finally transplanted; treatment after transplanting; effects of the hot winds and of the monsoons on the young plants: (c) Dates of flowering and fruiting; height and girth of trees on those dates: (d) *Quality of pods*: (e) Proportion between male and female trees among the plants raised from seeds: (f) Size attained by trees of known age.

The Government of India has decided that, outside of Madras and Bombay, the further experimental cultivation of the tree shall be limited, for the present, to the North-West Provinces and Oudh and to the Punjab. Samples of the fruit produced will be sent to be examined and reported upon by the Superintendent of the Botanical Garden at Saháranpur.

G. J. V. S.

Yellapur Saw-mills in North Kanara.

By MR. E. D. M. HOOPER, *Asst. Consr. of Forests, Central Provinces.*

(*Extract from Circular of the Government of India, No. 49F, dated 26th August 1878.*)

AN account of the saw-mills at Yellapur, and their early history, has already been published and circulated to forest officers; it will, therefore, be sufficient if I give my opinion as to the merits of the different component machines, and point out in what particulars these saw-mills contrast favourably with those set up at Ahiri in the Central Provinces.

The saw-mills are situated at Konagheri, from which village a forest-road is cut joining on to the high road leading from Halyal to Yellapur; the actual distance of the mills from Yellapur, the head-quarters of the district officer, is five miles.

All the machinery is conveniently placed under a lofty shed, roofed with corrugated iron, and to this shed the logs are brought from the depôt in carts drawn by coolies; a large iron hook at the back of each cart is connected with the drag-hole of the log by means of a chain.

The machinery is driven by twin-engines constructed by Ransome, Sims and Head, each of 12 horse-power nominal, which work one shaft with which all the different machines are connected. These machines are six in number, and consist of—

- 1 horizontal single-blade saw;
- 1 large rack circular saw;
- 2 smaller circular saws;
- 2 saw sharpeners.

The horizontal single-bladed saw is employed for the slabbing of round logs. In this machine, slabs can be cut as deep as eight inches. The squared log is then cut up into large scantlings by the rack circular saw, which is a full-powered one, carrying saws up to six feet diameter. The smaller circular saws are employed on the cuttings of smaller scantlings and plankings of slight width. The saw sharpeners are always fully employed in feeding the other machines with sharp saws.

The engines are constructed of the newest style, and furnished with all recent improvements; but, notwithstanding this, they are considered *deficient in power* for the working of the whole of the machinery at one time. I believe the explanation of this insufficiency of horse-power in the engines supplied is that original estimates were framed on the supposition that what is sufficient for the cutting up of European timber would be sufficient for Indian woods; but these latter are *much harder*, and offer an increased resistance to the saw; and, consequently, in the framing of estimates, it is as well to provide horse-power *considerably in excess* of what is deemed necessary by machine-makers for the cutting up of the deals and other soft woods so generally in demand at home.

The horizontal saw gives most accurate work, slabbing logs most evenly; but it must be allowed that there are considerable disadvantages which militate against its being generally employed in forest saw-mills; of these drawbacks the most noteworthy appears to be that it consumes a great deal of power to attain a comparatively small result, as its full effect is to cut slabs, 8 inches deep, one at a time from off a large log. The gearing and wheel-work connecting the saw with the main shaft is very complicated, and the machines requires two iron frames, one in which the saw works, and the other to which the fly-wheel is suspended. This complexity, and heaviness generally of the machine in question, tend to make its initial cost very much greater, and effectually to reduce its portability—a quality essentially requisite in any forest saw-machinery. It cannot be regarded either as a quick-working machine; for though it is supposed to slab a log at the rate of 2 feet in one minute, it cannot really saw much quicker than one foot in that time, any increase in this rate being apt to clog the saw.

The large rack circular saw is a most powerful and speedy machine, and in consequence turns out a great quantity of work; but the employment of such large saws as these having a diameter of 6 feet which this saw-bench takes, naturally requires a large amount of engine-power. The self-acting property of the table is a great point in favour of this machine, as

it does away with the necessity of employing the manual labour otherwise required to pass the logs through the saw.

The smaller circular saw-benches are also most useful adjuncts to the mill; the out-turn in small planks and scantlings is considerable, and these machines may be said to act very satisfactorily.

The chief differences traceable between these and the Ahiri mills are as follows:—

1st.—In Kanara, there are 6 horse-power available in excess of those at Ahiri; the 24 horse-power of the Kanara engines work 6 machines, whilst the 18 horse-power of the Ahiri mills are distributed over the working of 5 machines.

2nd.—The circular saws in use in Kanara range up to 72 inches, whilst the maximum size used in Ahiri is 42 inches.

3rd.—The place of the vertical frame in Ahiri is taken in Kanara by a single horizontal saw.

4th.—There is a certificated Engineer Assistant in Kanara; whilst at Ahiri the forest officer is his own Engineer.

With reference to the first of these differences, it is acknowledged in both cases that the power of the engines is quite inadequate to the work required of them; and taking the whole of the machines into consideration, it would appear that this inadequacy is even more marked in Kanara than with us; but at Ahiri we work under the additional disadvantage of having one engine of an old pattern, which is more apt to get out of repair than those in Kanara which are new, and consequently in good working order.

The rack-frame, taking 6 feet diameter saws with which the Kanara mills are furnished, is a machine which would require a very large amount of power to work at its full strength. In a paper read by Mr. R. Thompson, at the Forest Conference in 1875, he said that to work 40-inch saws effectively from 18 to 20 horse-power were necessary; it, therefore, stands to reason that what is available to drive the 6-feet saws in Kanara is quite insufficient to secure the full work of which the machine is capable. In another paragraph of Mr. Thompson's interest-

ing paper, already alluded to, he gave it as his opinion that the maximum size of circular saw required in a forest saw-mill is 60 inches; and it is a matter for determination whether the expenditure of engine-power necessary to drive the larger saw is compensated by its increased usefulness in cutting up larger pieces.

The purchase of a vertical frame for the Kanara mills was objected to in the first instance on account of its non-portability, but this objection has lost considerable force now that it has been decided not to disturb the mills for at least 10 years; in fact, I believe that it is now being considered whether the addition of a vertical frame shall not be made. If this be eventually carried out, considerably more power will be required, unless it is intended to replace the present horizontal saw, and even then its full effect would not be obtainable. Such an addition would have the effect of feeding the rack circular bench at least double as fast as it is fed at present, though it might rob this machine of some of its present utility: again, in the event of the large circular saw breaking down, it might be fitted with more saws and cut up planking on its own account, and thus feed the smaller circular saws direct.

The very possible contingency of the Karwar and Dharwar line of railway being constructed, would give a much greater importance to these mills, as, from their proximity to the sanctioned route, they would necessarily be indented upon for a large supply of sleepers; and the certainty of having to comply with a large indent for sleepers and rolling-stock timber, would allow of considerable additions, both of engine-power and machines, being made with a certainty of soon recouping the outlay incurred.

The last difference between these two mills that may be mentioned is that the Forest Department, Bombay, have availed themselves of the services of a mechanical Engineer, who was until lately employed in the Bombay Marine. This officer has been appointed to the Forest Department as a Sub-Assistant Conservator, and placed in charge of the depôt and saw-mills. By this arrangement, there is always an experienced European in constant attendance, and the risk of any serious damage

occurring is lessened by the certainty of an earlier detection of anything going wrong; and not the least benefit derived from this arrangement is that the district forest officer is thereby enabled to devote more time to his legitimate forest duties, the onerous nature of which may be inferred from the fact that the yearly forest revenue from the Kanara District exceeds 3 lakhs of rupees.

The out-turn of the mills is utilised in complying with the indents received from the Public Works Department in the Districts of Kanara, Dharwar and Belgaum, and the demand for teak and jungle wood scantlings being in excess of the supply, nothing but waste slabs accumulate.

The Forests of Canada.

From The Timber Trades' Journal, March 16, 1878.

WE are favoured by Mr. H. C. Jolly, Member of the Dominion Council of Agriculture, with a copy of his interesting and valuable report on Forestry and the Forests of Canada, from which we take the following extracts :—

Before entering into the question of forestry, or the management of our forests, it appears logical to inquire, first, into their present state. Though we have, in Canada, tracts of forest land owned by individuals, which would be deemed considerable in Europe, my inquiries will be mainly directed to our public forests, as they yield, by far, the largest proportion of our timber export, and as it will be found difficult enough to deal with them in a satisfactory manner, without complicating the question by attempting to regulate the management of our private forests. One thing at a time. Our public forests are worked by the lumbermen under a license system, entailing ground rent and stumpage dues. They contain a great variety of timber, but I will principally call your attention to the pine and spruce, as they form nearly all our export to Europe, and are really the produce of our forests; while the hardwood we export, especially the fine oak, nearly all comes, at present, from the Lake regions of the United States, as we have very

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little of our own left. For some time past the idea has been gaining ground, among men who take an interest in the future of the country, that our great pine and spruce forests are getting rapidly exhausted, and that, before long, a trade which enables us to export annually over twenty millions of dollars' worth of timber (nearly twenty-seven millions in 1874, twenty-five millions in 1875, and twenty millions three hundred thousand in 1876) will shrink down to woefully reduced proportions. Thinking men have begun to sound the note of alarm; we owe it to them, but especially to ourselves as a nation, to try and find out how far their previsions are likely to prove true.

The inquiry presents considerable difficulties. When, a short time ago, England was startled with the statement that her supply of coal was decreasing with alarming rapidity, she never rested until her mining engineers had measured her coal-fields, calculated their probable yield, and showed that there was still in England a supply of coals sufficient to meet a regularly increasing demand, and last for centuries. But we cannot calculate the yield of the forest of our days with the same facility and accuracy with which mining engineers can calculate the yield of the coal beds, the forests of past days. What is a coal bed but a mass of trees and plants, once growing more or less scattered over vast tracts of the old world, collected, brought together, piled up and compressed into a small volume by the mighty hand of God? How much easier it is to measure off the contents of a forest, condensed into such a small volume, whatever disappointments and errors may arise from faults and disturbances in the coal beds, than to calculate the contents of growing forests, scattered over half a continent from the Atlantic to the Pacific! Apart from our timber lands, a large portion of our territory consists of fertile prairies, with rare clumps of fine trees; in swamps without valuable timber, and in barren regions of rocky soil, with only a dwarf, stunted vegetation. In those parts of Canada where the soil and other circumstances are known to be generally favourable to the growth of pine and spruce, and where a pretty accurate idea can be formed of the quantity of timber already taken off by

the lumberman, who can say, without continually renewed investigations, how much is getting swept away every year by our great enemy, the fire fiend?

Let us now try and make an inventory of the timber resources of the Dominion, beginning in the west. On the Pacific shores of the Dominion, in British Columbia, the bountiful gifts of Providence are still stored up for us, and the forests have scarcely been attacked by the lumberman. How long those treasures will last us, and what advantages we shall derive from them, depend in a great measure upon ourselves. Let us now turn eastward, and see if we can learn there any lesson that will help us to manage our forests of the west. From the Rocky Mountains to the Province of Ontario there are scattered, here and there, certain tracts of well-timbered land; but they are the exception. That timber will be required for the local wants of the people who are now only beginning to settle our fertile prairies; and it will never, I think, contribute to swell the bulk of our timber exports. The great forest of Canada, *par excellence*, is spread over that vast territory watered by the Ottawa, the St. Maurice, the Saguenay, and their tributaries, over one hundred thousand square miles in extent; before drawing your attention more particularly to it I will mention our remaining timber limits, that cannot compare with it either for size or resources. They are found in the Georgian Bay country; the Muskoka and Nipissing regions; the eastern townships of Quebec and south shore of the St. Lawrence, to the Gulf; the region on the north shore of the St. Lawrence, from the Saguenay down to the Bersimis, and perhaps, still lower down, as far as Mingan; and the country watered by the St. John, the Miramichi, the Restigouche, and their tributaries. Those limits, in many places, are scattered and isolated; they have, with few exceptions (such as the Bersimis at the east, and some newly discovered pine tracts at the west, on Lake Superior), been worked for a long time, and cannot be expected to supply, much longer, any considerable quantity of first quality pine; but they still contain an immense quantity of spruce, principally in the east, sufficient for a great many years' supply, if carefully worked and protected. The spruce, unlike the pine, reproduces itself

with wonderful ease, and a good spruce country, carefully worked, where you leave untouched all the trees under a certain size, say twelve or thirteen inches at the foot, can be worked and worked again after a very few years' rest—I might say almost for ever. As a match to the timber wealth of British Columbia in the west there have been lately discovered at the extreme east of British North America, in the recent explorations through the hitherto unknown interior of Newfoundland, magnificent forests; let us hope that, before long, they will take their place among our Canadian forests.

I will now return to the great Canadian forest, our great pine country, with its wonderful network of streams, and its three great arteries, the Ottawa, the St. Maurice, and the Saguenay. Does it begin to show signs of exhaustion? Is it possible that, in such a short time, man has been able to make an impression upon those millions and millions of acres of forests? If there is no sign of exhaustion, what is the meaning of the complaints that come over the seas to us every year louder and louder, about the falling off, in quality and size, of our pine, hitherto considered as the finest in the world? Are they no more than the ordinary complaints of the purchaser? I leave it to our lumbermen to answer. But, before they answer, I will ask them why are they compelled to go now to such enormous distances for the really superior quality of pine they used to get so much nearer home a few years ago? Look at the map of that great region, and you will see how little of it is now left untouched. On the Ontario side, all the most accessible tributaries of the Ottawa, the Madawaska, the Bonnechere, Mississipi, Petewawa, and others have been worked for years; the lumbermen are now round the eastern end of Lake Nipissing, with the Matawan for an outlet to the Ottawa, that can only be reached by a land road; they are still much further north, on the shores of the Montreal River. On the Quebec side they have nearly reached the head waters of all the great tributaries of the Ottawa, the Rivière Rouge, the Rivière du Lièvre, the Gatineau, with the Jean de Terre and Lake Kakebonga, and the Lac des Rapides; they are now working three hundred miles higher up than Ottawa, as the river runs, on Lake Temiscamingue

and the Keepawa. On the St. Maurice, they are as far up as Lake Manco and on the western side of the river; its great tributaries on the eastern side, the Bostonnais and the Rivière Croche, have been deprived of the greatest part of their fine pine; it is now sought at the head waters of those rivers. As for the Saguenay region, it still contains a good deal of spruce, but there is only a limited extent of pine still untouched, or nearly so, south of Lake St. John, between the Metabetchouan and the head waters of the Rivière Croche, near Commissioner's Lake and Bouchette's Lake. There is a little pine left north of Lake St. John, and a certain quantity on the River Shipsha, and in the Lower Saguenay on the Ste. Marguerite and Petit St. Jean, &c. As for the large rivers that flow into Lake St. John, the Chamouchoua, Mistassine and Peribonca, the pine that was on the lower part of those rivers has been nearly all cut, and the remainder of their course from their distant northern sources is through an immense burnt-up wilderness, where the vegetable soil has been consumed by fire. That huge tract of lumber country, between the Ottawa and the St. Maurice, that separated (or rather appeared to separate) the lumbermen working on those two rivers, by what seemed an inexhaustible and endless forest,—that huge tract is tapped through and through, and the Ottawa lumberman has met the St. Maurice lumberman on the shores of Lake Manoran. A glance at the map will show what that means. Those who think that there will never be an end to our timber may say, "We can still go north." Not very far north. From Lake Temiscamingue and the Montreal River, on the shores of which the lumberman is plying his axe at this very moment, they cannot go very far north before they strike the height of lands, dividing the St. Lawrence water-shed from the Hudson's Bay, and the country is generally poor and barren. There is still some fine pine there, in what quantity is not known, along the head waters of the Ottawa, but it cannot be brought down to market, at least as square timber, until very extensive and costly works have been executed for the improvement of the great Rapide des Quinze. Once over the heights that divide the St. Lawrence and Hudson's Bay water-sheds one from another, the streams, without which timber cannot be

brought to market, all run to the north, to James' Bay and Hudson's Bay. Those regions are generally represented as a huge barren wilderness with little timber, and that mostly of a stunted growth. There is doubtless some good timber, but the idea of driving it down the Rupert, the Notway, the Harricana, and all those long rivers, to the shores of James' Bay, and taking it home down Hudson's Bay, eight hundred miles long, and through the dangerous Hudson's Strait, does not appear very practicable. Whatever timber is there may as well be considered as out of our reach for the present; in the course of time the scarcity of timber fit for export may become so great as to encourage the lumbermen to turn their efforts in that direction; but that region may safely be left out of our reckoning of the present available timber supply. In a very short time, since the beginning of this century, we have overrun our forests, picking out the finest pine, and we have impoverished them to a serious extent, and what makes it worse, impoverished the country too; for, owing to the force of circumstances which we shall consider later, our timber export trade has not given Canada such a return as she had a right to expect. There still remains to us a great deal of spruce and second-rate pine, which for generations to come will be in excess of our local wants if we are careful; but the really fine pine required to keep up our great timber export trade to its present standard is getting very scarce and inaccessible, and I fear that we must prepare for a sudden and considerable falling off.

Our neighbours in the United States have applied to the destruction of their forests their superhuman activity and energy, and they are now worse off than we are for timber. But their eyes are being opened; the President, in his last message, has earnestly drawn the attention of Congress to the subject, and the following quotation from the last annual report of the Secretary of the Interior shows how thoroughly they appreciate the gravity of the situation:—"The rapidity with which this country is stripped of its forests must alarm every thinking man. It has been estimated by good authority, that if we go on at the present rate, the supply of timber in the United States will in less than twenty years, fall considerably short of our home

necessities. It is the highest time that we should turn our earnest attention to this subject, which so seriously concerns our national prosperity." I do not fear so much on the score of deficient supply for our home necessities, but it is our great export trade that is in jeopardy. We have still got an enormous quantity of common timber on the Crown lands, and our people, beginning to appreciate the value of the wood that grows on their own farms, have generally ceased to look upon it as an incumbrance to be got rid of at any cost. But it was not always so, nor is it so everywhere even now. As far back as the year 1696 the attention of the French Governors of Canada was drawn to the wasteful destruction of the forests, and they were called upon to check it. Nothing, however, was done by them, and little has been done since. The result stares us reproachfully in the face, especially in the Province of Quebec, the oldest in the Dominion. The old settlements are painfully bare of trees; you can sometimes go miles without seeing any tree worth looking at; and the passing stranger fancies himself in a country more denuded of trees than the oldest parts of Europe. There is a large district of very good agricultural land south of Montreal, where the scarcity of firewood, which is a matter of life and death in our climate, has compelled many a farmer to sacrifice a fine farm and leave the country; there are many other spots in the Province nearly as bad; and unfortunately the process of destruction is going on even now in more places than one.

To sum up this first part of my report on "the present state of our forests," I must conclude by saying that it is very far from satisfactory, and leaves much room for improvement. What are the main causes of that unsatisfactory state? And is there any remedy? The great causes of the impoverishment of our forests are fire, depredation, and waste. I will begin by fire. We can cope with waste and pillage in our forests; they are but the work of man; but we are terribly helpless against fire. It is, in every country, the greatest enemy of the forest, especially the pine forest, on account of its resinous and inflammable nature. It is ubiquitous: you find it exercising its ravages wherever nature has planted its grand virgin

forests; in North America destroying the beautiful white pine, and at the antipodes, in New Zealand, sweeping away the noble Kawrie pine; through India, the Russian Empire, Sweden and Norway, it throws around the globe a girdle of lurid flames, only broken by the great oceans. It is estimated by those who are most competent to form an opinion on the subject that more pine timber has been destroyed by fire than has been cut down and taken out by the lumberman; not only is the large ripe timber destroyed by fire, but all the young trees too, upon whose growth we must depend for the restocking of our forests. It is not practicable in our Canadian woods to plant trees to take the place of those that are cut down. The difficulty of guarding against fire in such immense and distant forests as ours is enormous; and as for extinguishing it when once fairly started, the power of man cannot do that. It will sweep onward as long as it can find food, leaping at one bound like a giant over such rivers as the great Ottawa and Miramichi; and will only stop when brought to bay by large lakes, or when it reaches rocky or barren ground with nothing to burn; it will riot for weeks until starved for want of food, or drowned under torrents of long-expected rain.

In France and Germany, where the science of forestry is brought to a high state of perfection, where the forests are much smaller than ours, divided and isolated one from another, kept as much as possible free from rubbish and dead timber, and all the light stuff that carries on the flames so rapidly, protected by stringent laws, strictly enforced for generations, watched over by large staffs of foresters; even there disastrous fires are of frequent occurrence, and they call for such an effort to suppress them as is totally beyond our power, as the following example will show:—Considerable pine forests have been created within the last two or three generations in the south-west of France, and now cover large regions that were once barren heaps of sand rolled up far inland by the action of the sea. Those forests, created by man, now yielding a large and ever-increasing revenue, are highly valued and must be protected, one would think, as well as any forest can ever hope to be protected. Nevertheless, fires are frequent among

them. The people do there what we cannot do here, and generally conquer the fires, with more or less loss. But a short description of their mode of warfare will show how utterly inapplicable it is to our circumstances, and make us feel more than ever that our only hope is in prevention. In France, as soon as it is discovered that the forest is on fire, (which cannot take long where the forests are comparatively small, and the country thickly settled all round), the church bells ring in all the neighbouring villages. The whole population, trained by long practice, turn out with axes, spades, shovels, rakes, &c., under the guidance of acknowledged leaders. They combine their movements according to the direction of the wind and other circumstances, and dispose their forces with intelligence and promptitude. A mode often resorted to is the *contre-feu*, fighting the fire with fire, something not unlike what the hunters practise when overtaken by fires in our western prairies. Knowing the forest well, they direct their forces to one of the *coupe-feus* or safety strips (upon which no trees or shrubs are allowed to grow), or to the most favourable spot on the path of the fire at a sufficient distance ahead of it, form an extended line of workers wider than the fire, and set to work to remove as much of the inflammable materials as possible; they cut down, and burn, and trample, and shovel earth and carry away stuff, &c.; and when the fire, in its course, reaches that spot, it finds little food, hesitates, lingers, and at last is generally conquered. We cannot do that. Our forests are not surrounded by villages, the alarm bells cannot muster crowds of willing workers to our distant wilderness, often hundreds of miles away from man's dwellings. But if we cannot stop the fire, can we not do something to prevent it, and to limit its ravages? The best means adopted in Germany and France, and in Great Britain too (where the science of forestry is becoming an object of serious study), for preventing the spreading of the fire over a large extent of ground, is the laying out of their forests, and dividing them into isolated independent blocks, by means of the safety strips or *coupe-feus*. But even there, whenever the wind is very strong, it has been found that it would often carry inflammable matters, such as pine cones,

clear over everything, to a distance of one and even two miles, and start fresh fires where they fall, which will be readily believed by those who remember how easily fires have swept over the Ottawa river. Though not always sufficient, these safety strips are, nevertheless, of great service, but their opening is scarcely practicable with us. It would entail incredible cost and expenditure, on account of the great length we would have to prolong them, and the distance ; and because, furthermore, the brush and timber felled down to make them would have to be removed, otherwise it would soon dry up and increase the danger instead of decreasing it. Then, to maintain their efficiency, they would have to be kept clear of a new growth. We cannot think of undertaking such a gigantic work, at least in our large and remote forests. Neither can we undertake, as they do in Europe, to clear the underbrush and to remove the dead wood and rubbish ; it is an excellent precaution, and its adoption in Europe is not only free from cost, but even brings a large profit. Our circumstances are totally different, as every man of any experience must know ; and I will not enlarge upon that point. If we cannot profit by those good examples, we are nevertheless not going to sit down tamely and declare that nothing can be done. We can do a great deal to prevent our forests being set on fire. These fires are started by settlers clearing their lands ; by lumbermen whilst driving their timber down the stream ; by hunters and fishermen ; by sparks from locomotives ; by lightning ; sometimes even by the violent rubbing of dead branches one against another in gales of wind. We cannot very easily provide against the latter cause, as we cannot remove all our dead wood, and we cannot provide against lightning in the forest. But locomotives can keep down their sparks, with screens over their smoke-stacks. The railway companies are interested in every way in guarding against fires, and if they neglect to take sufficient precaution, they can be reached and called to account.

A frequent cause of disastrous fires in the woods is the mode of clearing land now generally followed by settlers. Of course they must have recourse to fires in order to clear wood lands,

but fire ought to be our servant, kept under continual control, not our master. Wood land can be cleared with comparatively little danger from fire, and be made ready to sow earlier than by the mode now generally in use (as I know from practical experience), if the settlers will only burn the shrubs, branches, leaves, and tops at once, as they cut them down. Light a good bright fire to start with, after having made a safe place for it, and then begin cutting away, and as you cut throw upon the fire at once ; children will help immensely with the light stuff, and willingly too. The fire once well started, everything will burn up, the green wood with the sap running out, and the green leaves too, not only those of fir trees, but of every hardwood tree. As you throw in the branches the whole of the green leaves upon them catch fire simultaneously with a sudden flash, and burn up with a crackling sound as if they had been steeped in grease. I have often done it, frequently in wet weather. We get rid immediately of all the light inflammable material, from which the greatest danger of bush-fires is to be apprehended ; the larger branches and trunks of trees, if you must burn them (which you ought not), present little danger of fire in dealing with them. When you get inconveniently distant from your first fire, you light a second one, and let your first one burn out ; it is remarkable that these fires generally burn down to the ground more thoroughly than the carefully constructed piles that have been drying up for a whole year.

Increased safety from fires is not the only advantage that would accrue to the settlers from the adoption of this mode of clearing wood lands. Take them as a whole, for the sake of comparing them, and this mode does not give more work than that now in use. True, you have got to convey the stuff you intend burning a little further, because one single fire, continued and replenished for some hours, will dispose of as much stuff as would have made one or two dozen average piles, but then think of the advantage of having got all that rubbish out of the way at once, instead of leaving it to cumber the ground until next year, when perhaps the season will be too rainy for burning, or so dry that you will run the risk of setting fire to your

own farm and the whole surrounding country. As the work is now done, even in a small clearing, no settler can keep all his fires under absolute control; he is obliged to wait for dry weather, and then he has got twenty, thirty, and more fires going on at once. A sudden gust of wind, which is often produced by the intensity of the fire itself in the stillest weather, and off the fire goes, reaches the woods close by, and meets there with such encouragement as to get very soon beyond human control.

The origin of many fires has been traced to lumbermen, hunters, and fishermen, but in no case have I heard of any evil intent, on their part, to do harm; it is through thoughtlessness; and they must be educated to prudence. Nothing is so striking as the contrast between a European, the first time he sets foot in our forests, and a Canadian, familiar with the woods; the feeling, amounting to actual veneration, with which the European will look at our boundless forest, the melancholy glance at the fallen tree, the sigh over the dead timber, rotting where it fell, the fierce denunciation of the great waste, and especially the reluctance at leaving behind him the smallest fire before it is thoroughly extinguished; on the other side, the naturally complete indifference of the Canadian, not only to the scenes with which he is familiar, but especially to the danger of fire. However difficult, or next to impossible, it would be to prevent the work of the incendiary, it is not impossible to force prudence upon the careless, and to open the eyes of the inexperienced. It will entail a much larger expenditure than is now incurred, as the number of forest rangers must, of necessity, be considerably increased; but if it is true that so much timber is destroyed by fire, (and no one will deny that the losses are enormous, however difficult it may be to compute the amount), is it not worth while protecting our forests from that danger, by devoting to such purpose a reasonable share of the large sums they yield every year to the public Exchequer?

Lumbermen.—They cannot set fire to the forests in winter, while carrying on all the operations necessary for the cutting, squaring, and hauling of the timber; the danger only exists

when they drive it down streams in the spring and often in summer. They light little fires wherever they stop on the banks of the rivers to dry their wet clothes and warm themselves, to enliven their few minutes of rest, or, when the season gets more advanced, to smoke away the flies. Before the fire is fairly blazing a shout is heard, and as the canoe, or the crib on the loose logs darts past, our friends take a flying leap upon them, and down they go with the swift current, leaving the fire to itself. It ought to be impressed upon the foremen, as one of their most important duties, that they must look after their men carefully in the matter of fires. As the lumbermen themselves have recommended in their conventions, careful men ought to be selected in each drive, to see that the fires are lighted and put out with every precaution; or a Government woodranger might be detailed for each drive or group of drives, when close enough for that purpose; or, should that entail too much expense, each woodranger might watch over a certain length of the river. The fires are only lighted on the banks of the streams during a drive, not inland; how easy it would be to throw the burning sticks or roll the burning logs in the water, with so many men at hand round a camp fire! A moment's reflection ought to convince all those who make their living by the forest that it is their interest to let the forest live. When the origin of a bush fire can be traced distinctly to the men employed on a certain drive of timber (which might often be accomplished with a good system of supervision), I cannot help thinking it is only fair that their employer should be made to feel his responsibility, and be deprived of his timber limits and license if he cannot make good the damage. A few examples of just severity would produce the best results.

Hunters.—Men who live by hunting, Indians and white men, do not often set fire to the forest; it is their home; neither is much to be feared from amateur hunters who conform to the game laws. All over the Dominion, the season for shooting such game as is found in the forest opens generally about the beginning of September, when the driest season is over and the autumn rains begin. This is a point upon which much stress is laid in the Forestry regulations of Europe, and perhaps our

game laws might be slightly modified to insure greater safety here.

Fishermen are more dangerous than hunters. It is not their fault, and I do not mean to cast any aspersion on their character; for when we see them exercise, in the pursuit of their avocation, so much patience and coolness, we are bound to credit them with the sister qualities of caution and prudence; it is the season during which fishing is allowed (and during which only it can be allowed), the driest part of the summer, that makes it so dangerous. In granting leases for the right of fishing in rivers, it would be advisable for the Government to increase the stringency of their regulations, so as to cause the lessees to be very careful how they themselves, their friends, and those under them, light and put out their fires.

There cannot be a greater waste of any marketable commodity than over-production. It is unavoidable, as the extraordinary success of a given branch of industry is certain to produce it; but, generally, it does not take long after its fatal effects are felt before the evil cures itself. Unfortunately, our timber trade is an exception to that rule; in the face of a glutted market we persist in our over-production, as if we expected to relieve the market by glutting it more and more. Over-production in the timber trade is a greater evil than in any other business, as the raw material cannot be replaced for generations. How ought it to be dealt with? People who dwell on abstract theories, and trust in the providential interference of the great law of demand and supply as the only source from which relief may flow, say, "What is the use of Canada attempting to decrease her production of timber? It will make no difference in the prices, as other countries will rush in and make up for the deficiency in our produce? They will benefit by our abstention; we won't." First, it will be of use in preserving our forests. Secondly, the other nations that might come in to make up for our deficiency, Sweden and Norway and Russia (I don't speak of Germany, as its excellent system of forestry places it in a much more favourable position), are destroying their forests just as fast as we are, and, as they began long before us, they are more advanced than we are in their work of destruction. They are producing as much as

they can produce ; to keep up the supply in Sweden and Norway they are now cutting their spruce trees when they have attained six or seven inches diameter, killing the goose with the golden eggs ; we are not reduced to that yet. Even in the matter of spruce they cannot ship deals as large as ours ; as for pine, where is the white pine (or yellow pine as it is called in England) with which they could replace ours ? It is idle to pretend that, if our production for next year were to be reduced, say, by one-half, especially in pine, that diminution would not produce a serious effect on the prices in England. Those who offer such arguments against the reduction of our production of timber are the same who, relying on the law of demand and supply as a panacea for all evils, say, " Let it alone, it will adjust itself sooner or later." It will be *later*, I fear, in this case. The lumbermen are more practical ; they know the only remedy is to decrease the production ; they acknowledge it in their conventions ; they try, earnestly no doubt, to apply the remedy—with what result is known to every one. With a few exceptions, the lumbermen of Canada, as a rule, cannot stop their production of timber ; they can scarcely curtail it. Without meaning any disrespect to a class of hard-working, honourable men, I think they may be considered (with the few exceptions above alluded to) as not being *free agents*. At every step they must feel their dependence on the will and caprice of others, from the obtaining of timber berths to work upon, the hiring of men, the supplying of provisions, the sending men, stores and horses hundreds of miles away into the wilderness down to the cutting, squaring, hauling, driving, booming, rafting, culling, loading, and shipping ; and this is why I use the unpalatable expression that they cannot be considered as free agents. Their relations with the advancers of money, the banks, the brokers, the purchasers in England, are of such a complicated nature, that it is difficult for them to realize at any time what their financial position is ; they know they are dependent upon others, they have been so from the beginning, and they continue so ; until at last, after long years of harassing, desperate work, with both body and mind worn out, they find themselves poorer than when they began. If this is not an overdrawn picture, if there is any truth in it, it will naturally be

asked, "Why are there so many men who still cling to the lumber trade?" They cannot help themselves; if they could shake off all connexion with the trade, what would they do next? How gladly many of them would take any other occupation if they could get it! See how many of the Ottawa lumbermen are now turning their eyes to the great phosphate deposits recently discovered on the Ottawa; they see there a new opening for their energies, and let us hope that many more such openings will present themselves before long. Our mineral wealth is great, and we might find in our mines during the long winter months an outlet for the activity of our agricultural population, which is now spent, to so little purpose, in the manufacture of timber for an overstocked market.

The lumbermen have indicated the remedy for over-production, but have not been able to apply it. They can only apply it successfully with the help of the Provincial Governments. I respectfully maintain that it is the right and the duty of those Governments to interfere: the right, because the timber belongs to the Province; the duty, because they are answerable for every stick of that timber. Each lumberman is ready to admit that he (or rather his neighbour) is cutting too much timber, and that he would make more profit with a lesser quantity. It is bad enough that so much money should be wasted away in cutting down timber for no good; but if there was an inexhaustible supply of timber on the Crown lands, the Government, receiving a larger amount of timber dues than it might otherwise, would not be likely to interfere to protect the lumberman against himself. But our forests are getting rapidly exhausted, and their produce sacrificed; it is a loss for Canada, and for the lumbermen. It is full time for the Governments to interfere. Will they do it, and can they do it, in justice? Of course, the first result of a decrease in the production of timber, in so far as the Government was concerned, would be a corresponding decrease in the Crown lands receipts. I won't call it the revenue, because there is something deceptive in the use of that word; we are apt to fancy that it always means (as Worcester has it) "the income or annual profit received from lands or other property." It is nothing of the kind in this case. We have not been spending the income or

annual profit of our forests, but the forests themselves,—not the interest, but the capital. It will be said that, without the large sums of money derived from the cutting of timber on our Crown lands, the building of railways could not have been encouraged as it has been. Nothing can contribute to the prosperity of a new country more than a railway carefully located so as to satisfy some great public necessity, without calling for sacrifices beyond the forces of the country; but while looking forward to the benefit to be derived from it, the cost must not be forgotten. We have been sacrificing our forests for the sake of our railways. So far as mere power is concerned, it seldom happens that a Government can control any trade as completely as our Provincial Governments can control the timber trade, without laying itself open to the charge of undue interference with business. In this case, the Governments themselves are parties to the trade, since they are the owners and the sellers of the standing timber. I do not advocate any infringement of vested rights, nor interference with existing arrangements, but a just and fair exercise of the control the Governments possess over their own property, whenever the occasion arises to exercise that control. If I am not mistaken, that occasion presents itself every year to the Provincial Governments. The Government of Quebec, however, is in an exceptional position; for a wise purpose, that of making timber-limit holders more careful of their limits, it bound itself several years ago to renew the timber-limit licenses until April, 1889; but it reserved to itself the right of changing the tariff of dues for cutting timber once during that period, on the 1st of September 1878, next autumn. I have been requested by the Federal Council of Agriculture “to suggest such measures as may be required to secure the systematic management of the timber regions of the Dominion, so as to balance the yearly cutting with their annual growth.” My duty is clearly to try and suggest such measures, even if it does not rest with the Federal Government to consider and adopt them. I cannot help it if matters are complicated by the fact that in no two Provinces of the Dominion can the question be considered from exactly the same point of view, and dealt with as if it were an isolated question, to be taken on its own merits, owing to the difference in the

financial status of the different Provinces. But if we wish to save our forests, the necessity for the prompt application of some effectual remedy is the same in every Province; the quantity of timber cut every year must be considerably reduced, if we wish to balance the yearly cutting of our forests with their annual growth. The revenue of our Crown lands must shrink of course, but it will become a *bonâ fide* revenue upon which we can permanently rely. To sum up: The Provincial Governments can do a great deal towards checking the over-production of timber, improving thereby the tone of the timber market and preserving our forests. Opinions will be divided as to the best and fairest mode of action, and as to the right of the Governments to interfere. If they can alter the amount of timber dues, they can interfere most effectively, and without exceeding the limits of their power, and compel, if need be, the lumbermen to submit to such just restrictions as will preserve our forests from destruction. I would recommend limiting the lumberman to a maximum cut of so many thousand feet per square mile of his limits. Let it be understood, I do not mean that he should have to cut so much on each and every individual square mile, but that out of his whole limit he should not take more than at the rate of so many feet per square mile. Of course, any plan that may be adopted will require very careful consideration and adjustment.

In making square pine, the waste of timber is generally estimated at one-fourth of the whole, and the best part of the tree, too, that part which in saw-logs gives the splendid broad deals for which Canada is famous. As it is not every tree that is sound enough for square timber, many a pine is cut down and left to rot. There may be something wrong about the heart or in the length, that would not have prevented it from being turned into saw-logs, but will not do for square timber, and so it is condemned. Chips made in squaring trees considerably increase the danger of fire. In summer they get very dry and inflammable, and the way in which they are disposed in straight lines, thirty, forty, and fifty feet long, like trains of gunpowder, appears well calculated for spreading the flames through the dead pine leaves, dry branches, and moss. But perhaps they cannot do without these huge beams of timber in England? In most cases the first

(thing they do when they get them there is to cut them up. Those splendid beams, fit for giant's works, upon which we, Canadians, are won't to gaze with so much pride, and which have caused us to waste (in order to maintain their noble proportions) so much valuable timber in squaring them, so much trouble in hauling, handling, stowing on board ship, are cut up, past recognition, as soon as they land. It is quite right for the buyer to cut them up, if he likes, in order to produce the smaller-sized lumber he requires. But why don't we send him that smaller-sized lumber instead of huge sticks? It would give employment to our people, and save the good timber that is now wasted in squaring. I think it would come cheaper to the consumer in England. Square timber is not invariably sound all through; when cut up, unexpected flaws and rots are often discovered that were invisible from the outside. Those flaws would have been discovered if the timber had been sawn up here, and the defective parts would not have been sent across. The difficulty is in reaching the consumer in England, but the distance is not the greatest obstacle. Between the consumers and the Canadian lumberman stand a few men, the importers of square timber. It is their steam mills that cut up our big square sticks into bits; their interest is directly opposed to our sending timber reduced by us to such dimensions as would suit the consumers, and they oppose strenuously the introduction of our two-inch deals, inch planks, narrow deals, &c. No one can blame them for standing between the Canadian producer and the British consumer, and for making money out of both. But could we not get nearer to the consumer in England? Could we not find out what qualities and dimensions of timber are most generally in request, send them over to England, and keep assortments of them within easy reach of the consumers? Why should we condemn ourselves to part with our timber in its rough state, as we may consider square sticks, or three and two-inch deals, leaving to others all the profit of working it? Why can we not send timber of every size, and width and length required, from railway timber, beams for houses, narrow strips of spruce for flooring, ready to lay down, door-frames, window-sashes? It would give us a large increase of work, and help us to dispose, with profit, of a quantity of pieces

of timber, sidings, cuttings, ends, slabs, that are now lost. For several years past some of our most enterprising manufacturers have been sending some cargoes of worked timber to South America, Australia, &c., but we still send the great bulk of our production, unmanufactured, to England. Last summer a Quebec firm sent pine boards, one inch thick, to Great Britain: I hope the result will encourage them to continue and increase those shipments, as they are rendering a real service to the country.

Look at Norway and Sweden, which send more lumber to England than the whole of British North America. Where would their lumbermen be if they limited themselves to the shipping of large sticks of square timber, and did not export any sawn spruce smaller than three inches by seven, or two by nine, as we do? There, a spruce log, nine inches in diameter, is considered as a large log, above the average. Here, such a log would be too small to pass through our saw-mills, with the saws set for cutting spruce for the English market, such as we allow ourselves to be limited to. As Mr. Wm. Stevenson says, in one of his interesting chapters on timber in the *Timber Trades' Journal* of 3rd March last, "One of the most characteristic features of the wood trade of Norway is the small size of the trees; a traveller may journey for miles along the banks of such important waterways as the Glommen, and be unable to distinguish anything larger than pit props or telegraph poles." The Norwegians manage to turn their small spruce to good account, and send it to England in narrow strips, planed, tongued and grooved, ready for flooring, and in all sorts of manufactured forms. I totally disapprove of their cutting down their small trees instead of letting them grow, and do not point to their example on that head as one to be followed, quite the reverse. But I strongly approve of their keeping as much work as they can at home, and of using every part of a tree, when once it is down, and hope the time is not far distant when we shall do the same. Of course, we shall make very little square timber when that time comes. The square timber makers will say, "We know what we are about; it pays us to make square timber, otherwise we would not make it." I dare say it may pay them. But does it pay

the country at large? What becomes of that fourth part of every tree that is lost in the squaring? Does the lumberman pay for it? Does he pay for all the trees that he fells and leaves to rot, on account of some defect which, in most cases, would not have unfitted them for making saw-logs? I trust the Provincial Governments will find it advisable to remodel the tariff of timber dues, and charge such a price per cubic foot for square timber as will, if not completely stop its production, at least check it considerably. If they cannot do without our square timber abroad, they will have to pay a higher price for it. There is another way of meeting the difficulty, if the Provincial Governments cannot agree on some joint action. There is now, and there has been for years past, an export duty on shingle bolts, stave bolts, oak logs, spruce logs, and pine logs; let the Federal Parliament put an export duty on square timber.

The Esparto Grass Trade of Tunis.

THE following detailed account of the manner in which the esparto grass is collected and shipped may not be without interest, especially since many inquiries have been addressed to Vice-Consul Dupuis on the subject. Although more goes to Great Britain from Susa, yet the quantities collected on the more southern coast and shipped at Sfax and Gerba are very considerable, and may eventually exceed those at Susa, on account of shortness of distances and conveyance by water, rather than by camels, which is always costly. It is brought during a few months of the year, loose in bundles, from a number of places to Sfax and Gerba in boats, averaging from two to twenty tons. A good deal comes from Shebbah, some 35 miles to the north, and not an inconsiderable quantity by land-transport from Agareb, 20 miles inland. From the hills of Hamamah also and Zluss, large supplies have lately been sent. Much comes from Shirah, 50 miles south, during four months of the year. At two or three days' journey inland from Susa the grass grows over a large tract of country, as is the case at Gabes, a name pretty well known, and some 30 miles further south round the coast. Here, likewise, the Akariat

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flows into the sea, being one of the few rivers in the country which sends water to the sea all the year round. It irrigates a strip of land about half a mile in width on its left bank, extending many miles up its course, and a luxuriant vegetation appears in strong contrast with the bare plains around. The staple product is the date of the different qualities consumed in the country. The last mile of the channel of the river forms a tidal harbour, which admits of the passage of boats up to seven tons burden only. Yet considerable trouble is experienced by them in bringing down the grass when the sea is at all rough, on account of the bar formed by the accumulation of sand at the entrance. It sometimes also happens that navigation is altogether suspended from the choking up of the passage for the waters, and the sand has to be cleared away at considerable cost and labour. It is to be noted too that loaded boats can only pass freely up the river during the ten days at spring tides, and empty ones during five days at neap tides. The right bank of the river close to the sea is high and steep, and the bundles of grass have to be pitched over into the barges beneath. Sometimes, without any other contrivance than what can be supplied by the rigging and a few planks, bales are put on board.

Shipments are made from the port of Susa direct to England, but owing to the bad holding ground and the shallows, vessels loading lie twelve miles to the northward, where they find good anchorage some two miles from the shore. The bales of grass are first weighed near the river, and then put on board the lighters as described, during the ten days of spring tides. If, owing to the neap tides, the lighters cannot approach, bales are carried down half a mile over the sands, below the bar, where they are easily shipped if the water is at all smooth, and the wind from the land. Zarat, 25 miles further south, is another station from which supplies are drawn. Its small harbour is formed by the narrow estuary of a stream, which runs only after heavy rains. Green or Bugreen, about 80 miles from Sfax, is another place which furnishes large supplies. It is brought from a distance of half a day's journey at the nearest, to three or four at the farthest. It is to be understood that the

supplies near the coast become soon exhausted, and only if prices offer well can they be sought for at a distance.

These are the principal stations where the grass is collected. At Shirah and Green there are no villages near the shipping places, and the agents have to camp out. At Zarat there is a small one, but some distance off, where there is a tepid spring which irrigates groves of palm and other trees. At the former two places only brackish water is to be had. Though at Gabes it is plentiful, yet it is all hard and brackish. Besides the mentioned places, there are those of minor importance, such as Bugarah, in the bay, indenting the land opposite to the island of Gerba, and Zerzis, a port 30 miles from the Tripoli frontier, where good anchorage is to be found even for large vessels if it were open to foreign trade. The following is the way in which the grass is collected:—Much is brought by the Arabs themselves to the markets. Money or goods are often paid or consigned in advance for grass, which is to be delivered at some indicated shore-station. Advances also are made for that which is yet to be pulled and got ready for transfer, when animals have to be hired to bring it to the coast. Buyers are sometimes sent out to an Arab encampment, which serves as a centre, and take with them money or goods (the latter generally), oil and cloth (last year, barley), which they barter for the grass and then bring to the coast.—*Journal of the Society of Arts, April 25th, 1879.*

Preservation of Forests.

Extracts from the "Scientific American" of the 8th March 1879.

IN an article with the above title in the *North American Review*, Felix L. Oswald, after reviewing the disastrous effects which have followed the wholesale destruction of forests in various countries of the world, remarks that since the year 1835 the forest area of the western hemisphere has decreased at the average yearly rate of 7,600,000 acres, or about 11,400 square miles; in the United States alone this rate has advanced from 1600 square miles in 1835, to 7000 in 1855, and 8400 in 1876. Between 1750 and 1835 the total aggregate of

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forests felled in South and Central America (especially in south-eastern Mexico), and in the eastern, south-eastern, and south-western States of our republic, may be estimated at from 45,000,000 to 50,000,000 acres. In other words, we have been wasting the moisture supply of the American soil at the average ratio of seven per cent. for each quarter of a century during the last one hundred and twenty-five years, and are now fast approaching the limit beyond which any further decrease will affect the climatic phenomena of the entire continent.

If we consider how the agricultural products of the eastern continents become from year to year more inadequate to the wants of their still growing population, we may foresee the time when the hope of the world will depend on the productiveness of the American soil ; but that productiveness depends on the fertilizing influence of the American forests. If they are gone we shall have on earth no newer world to hope for ; no future Columbus can alleviate the struggle for existence. To stay such a catastrophe the author suggests that in every township, where the disappearance of arboreal vegetation begins to affect the perennial springs and water-courses or the fertility of the fields, a space of, say, 50 acres should be appropriated for a " township grove," an oasis to be consecrated for ever to shade trees, birds' nests, picnics, and playing children. In all new settlements, where a remnant of the primeval forests has survived, let the woods on the upper ridges or on the summit of isolated hills be spared by mutual agreement of the proprietors. In the treeless regions of the great West not only amateur societies, but every grange and farmers' union of every county, should devote themselves to the work of tree culture, and every landed proprietor should see to it that the boundaries of his estates be set with shade trees, and that wooden fences be supplanted by quickset hedges. Let fruit trees be planted wherever there is a piece of ground, neither otherwise occupied nor absolutely barren ; and be sure that their influence on the atmosphere in summer, and their fertilizing leaves in fall will more than indemnify the adjoining fields for the modicum of sunlight they may intercept.

Any state where these precautions should be generally adopted would soon be so unmistakably distinguished by the unfailing humidity and freshness of its fields and the abundance of its crops that the sheer necessity of competition would induce backward neighbours to try the same experiment; and before long the maxim would not only be generally recognized, but generally acted upon, that husbandry and tree culture are inseparable.

Applications for leave by Uncovenanted Officers of the Forest Department, whose salary bills are audited by the Comptroller-General, Calcutta.

By A. L. HOME, *Deputy Conservator of Forests.*

Uncovenanted Officers entitled to leave under the Civil Leave Code. (Paras. 1 to 15.)

Uncovenanted Officers entitled to leave under Supplement F. of the Civil Leave Code (Paras. 16 and 17).

1. Uncovenanted Officers may take furlough either out of India or in India, and this furlough may be on private affairs or on medical certificate; they are also entitled to special leave of absence and to privilege leave. The rules under which each class of leave can be granted are to be found in the Civil Leave Code, and in Supplement F. of that Code, and this note is merely intended to remind officers applying for leave out of India or in India of the preliminaries required by the Leave Code, so that they may ensure the regular payment of their allowances while on leave. The forms of last pay certificate referred to are given in Appendix A to the Civil Leave Code.*

(1) FURLOUGH ON PRIVATE AFFAIRS OUT OF INDIA.

2. When an Uncovenanted Officer entitled to leave under the

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51, 1), and state the amount of subsidiary leave he requires to enable him to reach the port of embarkation. This application should be sent through the Conservator to the Comptroller-General, Calcutta, in the usual form (hereto attached). The Comptroller-General will forward the application with his report to the Local Government for transmission to the Government of India, or, in the case of officers serving in Bengal, the North-Western Provinces and Oude and the Punjab, to the Local Government, as required in para. 65 of the Forest Department Code, and if the leave is granted, the following procedure should be adopted :—

(a.) *If the applicant embarks from Calcutta.*

3. He should bring with him :—

(1.) A last pay certificate (specimen form hereto attached) signed by the officer in charge of the Forest Division to which he was last attached ;

(2.) A certificate of transfer of charge, in Forest Department Code Form No. 44 ;

(3.) The order granting him leave ;

(4.) And a bill for all sums due to him up to and including the date of his departure from Calcutta.

4. The officer should present himself at the office of the Comptroller-General, with the above documents, and state the date on which he proposes to sail. The Assistant Comptroller-General will audit the bill and endorse it for payment at the local treasury, and give the officer a last pay certificate (Form A, Appendix A) to present for payment of his furlough allowances at the India Office in London. Each officer embarking from Calcutta will also receive a printed form of certificate for the pilot to sign, and this form, when signed, will be forwarded to the Comptroller-General by post. A similar certificate will be filled up and signed by the pilot at the foot of the last pay certificate (Form A, Appendix A), made over by the Assistant Comptroller-General to the officer proceeding on leave.

5. The officer on leaving India will report the actual date of his departure, and the date on which the pilot makes over charge at the Sandheads, to his own Government, through the Conservator, and on arriving in England he should report his arrival to the Under-Secretary of State at the India Office.

6. It will considerably facilitate the preparation of the last pay certificate if a full week's notice (official or demi-official) is given

to the Assistant Comptroller-General of the intention to proceed on leave out of India, and of the date and hour the officer proceeding on leave intends to make over charge to his successor, as the register of services for the preceding three years has in every case to be examined, and in case of a first furlough, the register from the commencement of the officer's service has to be verified.

(b.) *If the officer does not embark from Calcutta.*

7. On leave being granted the Comptroller-General will, on receipt from the Conservator of the information required in clauses (1) to (3) of para. 3 above, and on being informed of the port at which the officer intends to embark, send the officer proceeding on leave a certificate (Form B, Appendix A), leaving the 7th, 9th, and 10th spaces blank, and will forward a duplicate to the Accountant-General or Treasury Officer at the port of embarkation.

8. The officer should present himself at the office of the Accountant-General or Treasury Officer at the port of embarkation with the last pay certificate sent to him by the Comptroller-General, and a copy of the order granting him the leave, and inform the Accountant-General of the date on which he proposes to sail. The Accountant-General will follow the instructions on the letter addressed to him on the reverse of Form B, and will pay the officer up to the date of departure from the port, and return him the original last pay certificate duly completed to present for payment of his furlough allowances at the India Office in London.

Note.—Should an officer be obliged to embark before he obtains his last pay certificate from the Comptroller-General, he should still report his departure to the Accountant-General or Treasury Officer at the port of embarkation, and to his own Government through the Conservator, and name an agent to represent him there or elsewhere. When the last pay certificate is ready it will be forwarded (both original and duplicate) to the Accountant-General at the port of embarkation, who will complete it, and hand over the original to the agent named by the officer, together with any arrears of pay due up to the date of embarkation, for transmission to the officer concerned.

(2.) FURLOUGH ON PRIVATE AFFAIRS IN INDIA.

9. Para. 2, above, rules applications of this nature also, except that subsidiary leave is not allowed. When the leave has been granted the officer should send the Comptroller-General the papers required by clauses (1) to (3) of para. 3 above, through the Conservator, and should also name the District Treasury or Forest Office from which he wishes to draw his pay. The Comptroller-General

will then give him a last pay certificate in Form A,* which will enable him to draw his allowances at the Treasury or Forest Office named therein.

Note.—If during the time of his leave he wishes to change the Treasury from which he draws his allowances, or to complete his furlough in Europe and draw his allowances from the India Office, he should submit an application to the Comptroller-General, accompanied by a last pay certificate from the Treasury or Forest Office concerned.

At the expiration of his leave he should obtain a last pay certificate from the officer in charge of the Treasury where he has been drawing his allowances. This certificate will be attached to his first pay bill after return to duty.

(3.) FURLOUGH ON MEDICAL CERTIFICATE OUT OF INDIA.

10. The application in this case, besides quoting the section under which leave is claimed, should be supported by a medical certificate in the Form given in section 51, rule 7, of the Civil Leave Code. The applicant should ordinarily appear with two statements of his case before the Medical Board at Bombay or Calcutta, or before the Medical Board at the seat of the Government under which he is serving, and from them obtain the further certificate required by section 51, rule 8.

11. Should, however, the state of the applicant's health be certified by a covenanted medical officer or by a medical officer in charge of civil station to be such as to make it highly inconvenient for him to repair to the seat of the Government of the province to which he belongs, the local Government may accept the certificate of two medical men, (either covenanted or in charge of civil stations, neither of whom is the regular medical attendant of the applicant, but who need not belong to the same province,) in the Form given in section 51, rule 8, with this addition: "We further certify that the state of C. D.'s health is such as to render it highly inconvenient for him to proceed to ."

The name of the station at which he is examined should also be given. The Comptroller-General, on receipt of the application and certificates through the Conservator, will forward them with his report to the Local Government, who will send a duplicate of the medical report on the case to the Secretary of State for the information of the Medical Board attached to the India Office.

* If the leave allowance be drawn from a District Treasury, the Accountant-General of the Province in which the Treasury is situated will be furnished with a duplicate of the last pay certificate.

12. If the furlough and subsidiary leave be granted, the subsequent procedure will in all cases be the same as in cases of ordinary furlough described above. When subsidiary leave and furlough have been granted on the certificate described in section 51, rule 7, of the Civil Leave Code, subject to the applicant's procuring the certificate prescribed in section 51, rule 8, either from the Board at the head-quarters of his own province or at the port of embarkation, a note to that effect will be made on the certificates, both original and duplicate, and the final certificate required by section 51, rule 8, must be given to the Comptroller-General if the officer embarks at Calcutta, or to the Accountant-General or Treasury Officer if he embarks from any other port, who will be asked to note the fact of its having been granted on the last pay certificates, and to return it to the Comptroller-General for submission to the Secretary of State through the Local Government. In all cases a copy of the certificate granted under section 51, rule 8, must be sent to the Comptroller-General for transmission to the Local Government.

(4) FURLOUGH ON MEDICAL CERTIFICATE IN INDIA.

13. The application here will specify the section of the Code under which leave is asked for, and the station at which the officer wishes to draw his allowances, and should be forwarded through the Conservator to the Comptroller-General with the certificate required by section 51, rule 7, of the Civil Leave Code. Unless the Local Government otherwise permit, the applicant must appear before the local Medical Board at the head-quarters of his province to procure the final certificate required in section 51, rule 8; and when such permission has been given, the certificate must be signed by two medical officers, either covenanted or in charge of civil stations, neither of whom is the applicant's regular medical attendant. A copy of the letter of Government exempting from attendance at head-quarters and the certificate under section 51, rule 8, should be sent to the Comptroller-General, who will forward the certificate with his report to the local Government, and, on leave being granted, will issue a last pay certificate in Form A, as described in para. 9 above. In all cases where medical certificates are required, the applicant should take with him before the medical officer or Board a statement of his case in duplicate.

(5.) PRIVILEGE LEAVE.

14. The application should state that the leave is claimed under the rules in Chapter VII of the Civil Leave Code, the amount of leave required, and a declaration in the following terms (section 44, rule 1):—"I, A. B., do hereby certify that I have no intention of retiring or taking furlough, special leave, subsidiary leave, leave on private affairs, or leave on medical certificate for three months after my return to duty from the leave now applied for." It should be forwarded through the Conservator to the Comptroller-General, who will forward it with his report to the local Government. An officer taking privilege leave may draw his allowances at any Treasury or Forest Office in India on the order of the Comptroller-General in the manner shown in para. 9 above.

15. No payment can be made out of India to a person absent on privilege leave, but the Comptroller-General may permit an officer's agent to draw his pay while absent on privilege leave on the conditions laid down in section 48, rule 5, of the Civil Leave Code. The agent or agents through whom the allowance is drawn in India should execute an indemnity bond in the form given below, and this bond should be stamped to cover such intermediate payments as are not supported by a life certificate, according to the scale laid down in the General Stamp Act (Act I of 1879). The last pay certificate, the certificate of having given over charge, and the names of the agents through whom the applicant wishes to draw his allowances, should be forwarded to the Comptroller-General, and the necessary orders to the disbursing treasury to honour the pay bills drawn by the agents to the extent covered by the indemnity bond will then be issued. For example, should A. B. leave his station on the 1st June and be entitled to an allowance of Rs. 500 a month while on privilege leave, he should direct his agents to execute a duly stamped indemnity bond for Rs. 500, which they will present with A. B.'s pay bill for June on the 1st July and draw his leave allowances for that month. A. B. will on the 1st July forward from England to his agents a life certificate, countersigned by a Covenanted Civil Servant, a Magistrate, a Notary, a Banker, or a Minister of religion, which his agents will present with A. B.'s pay bill for July on the 1st August, and thus relieve his indemnity bond of the first payment for June. Should A. B. not furnish the life certificate, he must either increase the

amount of the indemnity bond or forego the payment of his leave allowance until he appears in person.

The indemnity bond should be in the following form :—

We, the undersigned agents of A. B, do hereby engage, in the event of our being permitted to draw the salary of our constituent A. B., during his authorized absence from his presidency, to repay to the Government of India or its constituted officer all over-payments of leave allowance made to us on his account during his absence.

C. D.,

Agents of the abovementioned A. B.

Place.

Date.

Witness E. F.

16. Gazetted Uncovenanted Officers whose leave is regulated by the provisions of Supplement F. of the Civil Leave Code should, in cases of furlough and privilege leave, submit their applications in the manner explained above, stating the leave required and the section under which it is claimed. Section 18 (b), Rule 1, Supplement F. of the Civil Leave Code, gives the procedure to be followed by superior Uncovenanted Officers taking furlough on medical certificate.* The procedure after the grant of leave will, in all cases, be similar to that explained above in paras. 8 to 15.

17. The grant of leave to non-gazetted officers is made by the head of the department and need not be submitted to Government. A monthly return of all non-gazetted officers on leave accompanies each establishment pay bill. The rules regarding the grant of last pay certificates, &c., to non-gazetted officers are the same as those which apply to gazetted officers under Supplement F; but a non-gazetted officer, on any kind of leave in India, can draw his leave allowances only at the Forest Office where his salary is paid, and under the signature of the head of his office, who is responsible for any over-charges, (48 (a), 7).

* In the case of an officer who obtains medical leave in India under the rules in Supplement F, subsidiary leave is admissible when he proceeds to, and returns from, a sanitarium in India (Section 11, Supplement F.)

FORM OF APPLICATION FOR LEAVE.

Application for leave of Absence under Section _____
_____ of the Civil Leave Code.

Name and grade or class of Officer and appointment he holds.	Period and nature of leave applied for.	Description and period of last leave taken.	Recommendations of Conservator, with suggestions as to arrangements for absentee's work.
		Leaves from <div style="text-align: center;">■</div>	

N.B.—The section of the Leave Code (or its supplements) under which leave is claimed should always be noted in column 2.

The _____ 18 . }

Signature of Applicant.

(In case of privilege leave.)

I do hereby declare that I have no intention of retiring from the service, or of taking furlough, special leave, leave on private affairs, or leave on medical certificate, for three months after my return to duty from the leave now applied for.

No. _____

The _____ 18 .

Forwarded to the Comptroller-General, Calcutta, for submission to Government with the usual report.

Signature of Applicant.

Conservator of Forests.

Form of Last Pay Certificate on making over charge of a Forest Division.

Last pay certificate of _____

_____ Conservator of Forests, _____ grade
 proceeding on _____

He has drawn pay as _____

_____ at the rate of Rs. _____ a month,
 and acting allowance at the rate of Rs. _____ a month, up
 to the _____ 18 _____, and to no
 later date.

Dated _____

Conservator of Forests.

The _____ 18 . }

_____ Division.

II. OFFICIAL PAPERS.

The Indian Silk Industry in connection with the Paris Exhibition of 1878.

(Extract from the Proceedings of the Government of India, in the Department of Revenue, Agriculture, and Commerce, dated Calcutta, the 28th February 1879.)

IN the Resolution of the 23rd November 1875, the Government of India stated the facts regarding the production of tasar silk so far as they were known to it, as well as the steps taken or under consideration in reference to the utilization of this article and the development of a regular industry. The general conclusion which seemed to be justified by the information before it was that the domestication of the tasar worm offered no prospect of remuneration even if the process were in itself possible; but that if certain difficulties arising from natural conditions connected with the collection of the worm in its wild or in a semi-domesticated state could be overcome, and that if the silk could be satisfactorily reeled and dyed,—for difficulties had been encountered in connection with both processes,—a regular and extensive export trade from India to Europe, either in the shape of cocoons or as raw silk, would spring up; for it seemed certain that European manufacturers would take the raw produce if laid down at reasonable prices.

2. The first step to be taken, however, was to procure further information. It was obviously premature to take any measures having in view the creation of a regular industry without first obtaining definite information on important points on which information was wanting either wholly or in part. Such points were: the exact cost at which the raw material could be collected or produced in commercial quantities, both in the wild and semi-domesticated state; the cost of reeling the silk; the weight of silk in proportion to cocoon; the degree in

which the filaments would bear *croissance*; and the consequent ultimate value of the silk in the market. As a first step towards the obtainment of such data, the Government of Bombay and the Chief Commissioner of the Central Provinces were requested to collect a quantity of cocoons in order that careful experiments might be made with them in this country, as also under the direction of Her Majesty's Secretary of State in some of the leading filatures in France and Italy. This was done, and the results of the experiments undertaken by Mr. Wardle, under the direction of the Secretary of State with the cocoons thus supplied, are now before the Government of India, and are stated in his reports attached to this Resolution. No experiments were made in this country, the gentlemen to whom cocoons were supplied for the purpose having pronounced them to be old and unfit for reeling, especially in this country, where the special machinery and appliances required for this purpose are not available. This is of little consequence, however, considering the success of the experiments in Europe, and having regard to the fact that in all probability filatures in India for tasar silk will not be required, and that only a trade in cocoons will prove remunerative.

3. At the same time that these cocoons were collected in the Central Provinces, the other Local Governments and Administrations were invited to make proposals and suggestions in the matter.

4. The result of the enquiries and experiments made in India has not on the whole advanced matters very far. In the Bombay Presidency the experiments undertaken by Major Coussmaker for the semi-domestication of the worm were interrupted by the drought and famine. They have since been renewed, but as yet with inconclusive results. These are stated in a letter from Major Coussmaker, from which the following paragraphs are extracted :—

* * * * *

" 2. My former experiments, as well as those conducted by Mr. Woodrow, had proved that it was a mistake to attempt to rear these worms on twigs, either those cut from road-side trees, or from those which had received some care and attention

in a garden, and that the plan most likely to succeed was to feed them on shrubs in localities where they could be protected from their enemies, and, if need be, from unfavorable weather. With this view, I began to collect young plants.

"3. I had noticed in 1876 that the tasar worm thrived well on *Lagerstræmia indica*, an ornamental shrub, fairly abundant in the cantonment of Poona; this is a plant which throws up a good many suckers during the monsoon, and I soon got a few plants together. I took a house which was well supplied with shade and water, and my gardener managed to collect 172 plants between December and July, many of them only a few inches high, but some were large enough to be of use. There were also in the ground six bushes, and my first care, when I came in from the districts, was to cut them all back to the hard wood, and apply to their roots a fair amount of manure. The consequence was that as soon as the rain commenced the plants shot most freely into leaf.

"4. Mr. Woodrow had not been able to save any seed cocoons, but I had found three female cocoons in the districts, and the Marathi woman, who had been my chief assistant in looking after these worms before, had collected twelve. I soon had several moths from these cocoons, and found, as I had noticed before, that there was no difficulty in getting an abundant supply of fertile eggs. Hardly any females were wasted; it was only necessary to put them out over-night on any bush, and it was almost a certainty to find them paired at daybreak. I found that it was not necessary to tether them; they rarely moved from the twig on which I placed them. As fast as the young worms hatched out, I put the trays containing them among the leaves of the plants, and in a few hours they commenced feeding. The weather was everything I could desire, showery, with a few breaks of fine weather; the bushes were full of young shoots, and the worms thrived as I have never seen them thrive before. I tied bamboo screens together and covered over the plants as they stood in the open. The worms changed their skins at intervals of 4 to 5 days instead of 5 to 8, as had been the case when I reared them indoors on gathered food, and they spun their cocoons in 28 to 35 days instead of

40 to 50, as I had noted before. The moths came out of these cocoons in 27 to 30 days, and their eggs proved fertile, producing caterpillars which grew as fast and as large as the first. The only difference that I observed was that the 'cement' of the cocoons of the later crops was less uniformly white; this may have been due to the changes in the weather or the quality of the leaf, some shrubs having been eaten off three and four times this monsoon.

"5. The *Lagerstræmia* bush proved an excellent food; it flushed so quickly that a plant, 2 feet high, after being fed off quite bare, cut back, and re-potted, was again in thick leaf in a fortnight, and the same batch of worms stripped it again. In changing the plants, and in daily examining the cages, a few accidents occurred; but 100 worms yielded 71 cocoons.

"6. I enclosed an old *Carissa Carandas*, which had neither been pruned nor manured, with bamboo screens, and liberated 50 worms there. In the course of a month I gathered 31 cocoons, a little larger than those of the *Lagerstræmia*, but much harder and yellower. The caterpillars seemed to thrive a little better on this bush, and completely stripped it, but the tree did not recover quickly, and did not yield another supply of food the whole monsoon.

"7. I put six worms on to a young *Zizyphus Jujuba* tree in my garden, but neither enclosed it, pruned it, nor manured it. It had a great deal of leaf and flower on it, and the worms ate both. They grew very large and healthy, being in every stage of their existence a little ahead of some of the same batch feeding on *Lagerstræmia*. Five cocoons were spun here, larger than any that I had gathered from off the other trees.

"8. I let the majority of the moths fly away, for as soon as the male has left her, the female is quite ready to go and look for suitable trees to deposit her eggs on. I had not enough food for more than 100 worms at a time in my own compound, and almost every attempt which I made at bringing them up elsewhere, unsheltered by the screens, failed. Crows, squirrels, and other enemies carried them off, and I hardly got a single cocoon; but in my own compound I continued to rear a few at a time, changing them from one tree to another as I

found it expedient. The result of the experiments which I made shewed me plainly that plants in the ground with or without screens over them, gave the most suitable food; that it mattered not whether the young shoots were eaten down by the caterpillars or cut off by the pruning shears. The *Lagerstræmia* never sprouted again, and it was only the very limited supply of food which I had that prevented me rearing many more worms.

"9. From the single experiment I have mentioned, *Carissa* does not seem to recover quickly. *Zizyphus* seems to grow very fast, principally at the extremities of its long straggling branches; but as I only had one tree in my compound, I could not be sure about its usual habit of growth.

"10. I baked some of the cocoons gathered from each of these three trees, and sent them home to Mr. Wardle, asking him to give me an opinion on the qualities of the respective fibres. I had all the burst and injured cocoons cleaned, and sent them, together with those which Mr. Woodrow had on hand, to the Alliance Mills in Bombay to be converted into yarn. I have kept some fifty seed cocoons for next year's experiments.

"11. I have got together a good many plants for next season's experiments—353 *Lagerstræmia indica*, 10 *Lagerstræmia parviflora*, 13 *Conocarpus latifolia*, plants and cuttings all rooted and in leaf: also 136 *Carissa Carandas*, 135 *Zizyphus Jujuba*, 105 *Pentaptera tomentosa* seedlings. There are besides 3 *Zizyphus* bushes in the compound, and if my gardener will but take care of these during my eight months' absence from Poona, I hope to resume my experiments under better auspices.

"12. The past season has been very favorable for tasar worms. Mr. Lyle, who was cultivating them to a small extent at Dapuri in 1876, tells me that some of the men who were under him then came to him lately and asked him whether he wanted any more cocoons as they had seen several. He happened to be on the spot, and sent a man to see how many he could collect within three hours. He came back with 300, and said that he had heard that some people had been taking them into Poona for sale, presumably to the native physicians. I

myself have already found many more casually this year in the districts than I usually do."

* * * * *

5. In Madras, in the North-Western Provinces and Oudh, in Burma, and in the Hyderabad Assigned Districts, as also in Mysore, there would seem at present to be no prospect of establishing any traffic in the cocoons or raw silk of the undomesticated worm.

6. The late Chief Commissioner of Assam thought that any attempt to foster the trade in Sylhet would prove unsuccessful, and refrained from offering any suggestions beyond drawing attention to the existing and old-established silk industries of Assam, which, in his opinion, might have opened up a wide field for private enterprise were it not for the extraordinary delays that exist in communications between the province and the rest of India. Government have under consideration the question of improving the facilities for communicating with Upper Assam. It is hoped that when the contemplated improvement is effected, Colonel Keatinge's expectations will to some extent be realized; for there is at least as great a demand in the European markets for the cocoon of the eria and moonga worm as there is for that of the tasar.

7. In Bengal the tasar worm appears to abound in various localities generally, in all the tree and scrub jungle lying south and west of a line marking the southern and western limit of the continuous cultivation of the Gangetic alluvial and of the Orissa littoral. Whether the insect is of one or of several species, is a matter of doubt, and the season and mode of breeding and collecting appear to vary with the locality where it is found. The price of cocoons, it is alleged, ranges from Rs. 6 to Rs. 10 per kahan (1 kahan=16 pans of 80 cocoons each, i.e., 1,280 cocoons); and in regard to its yield, one kahan makes in Bankurah two pairs of dhotis, in Sooree 15 chittacks of silk, and in the Southal Pergunnahs from $1\frac{1}{2}$ to 2 seers. These and other more detailed particulars, furnished by the Government of Bengal, though admittedly incomplete and unauthenticated in some respects, are useful as far as they go, and the Government of India will be glad to be informed

of the measures which are being taken to gather further particulars as well as of their results. The Lieutenant-Governor's opinion on the proposal made by Mr. J. Deveria, to the effect that the State should undertake the rearing of tasar cocoons in the jungle mehals of Chota Nagpore for sale to reelers and exporters is also awaited.

8. From the Punjab, some samples of tasar silk, reeled from cocoons produced in the Hoshiarpur district by the Deputy Commissioner, were reported on by the authorities whom the Government of India consulted as fairly successful. Some specimens of cloth, which were also received from Hoshiarpur, were found to have been very creditably manufactured.

9. The Secretary of State, in acknowledging in his despatch No. 25, dated the 22nd March 1877, the receipt of the cocoons gathered in the Central Provinces, has forwarded a report by Mr. T. Wardle, from which it appears that, although the cocoons, when made over to the filatures in France and Italy, were found to be very old and imperfect, the reelers spoke most hopefully of the results that might be attained with fresher cocoons properly gathered and prepared. Mr. Wardle, too, said that he was prepared to dye tasar silk as reeled in Europe by his improved processes in almost any color, even to very pale shades.

10. The first part of a further report from Mr. Wardle has meanwhile been received under cover of the Secretary of State's despatch No. 61, dated the 29th August 1878; as also some samples of tasar silk displayed at the Paris Exhibition, as prepared under Mr. Wardle's instructions. These specimens, which can be seen at the office of this Department by persons interested in the matter, are far superior to anything ever yet seen of the same kind, the organzine especially being remarkable for its excellence. The grége is softer, cleaner, and altogether better than the best raw tasar silk as yet reeled. It is clear from these samples that such difficulties as existed in the reeling of this silk have been completely overcome. Mr. Wardle's process produces silk so fine as to be capable of adaptation to any purpose for which mulberry silk is used. Excel-

lent results have also been obtained in the spinning of tasar thread and the weaving of fabrics from spun silk. Mr. Wardle's experiments with the dyeing of the silk have also been quite successful. On the whole it is certain now that there is no inherent obstacle to the utilization of this silk for manufacturing purposes.

11. The main question now to be answered is that of cost. Whether silk of this kind will be extensively consumed, depends upon the price at which it can be placed in the market. Mr. Wardle states that the cost of marking organzine and tram from the cocoons is 20 francs the kilogramme, *viz.*, 10 francs for reeling and 10 francs for throwing. This is double the price at which ordinary tasars are now sold, and it is not easy to say whether purchasers will be found for the improved product, greatly superior as it is, though it seems that the price is susceptible of reduction. As yet the only indication of the prices likely to be given for tasar silk is an offer made by M. David, a silk manufacturer of St. Etienne, who expresses his readiness to take one or two thousand kilogrammes of cocoons delivered at Marseilles at the price of one franc the kilogramme. This price, it is clear, is much too low, for according to the information before the Government, cocoons could not profitably be laid down in Europe at less than three or four times the sum mentioned. This, however, is a matter which admits of local verification, and it should form the subject of enquiry.

12. The results obtained by Mr. Wardle, as well as by others working independently, are so important and so full of promise as regards the manufacture of this silk and the utilization of the manufacture for apparel and other purposes, that it is eminently desirable to thoroughly investigate the question of production. Information on this subject has been sought from various quarters, but the information in the possession of Government is not sufficient to enable it to furnish precise answers, yet it is necessary, if the attention of capitalists is to be attracted to the development of this industry, that full information should be forthcoming. M. Natalis Rondot, a delegate from the Chamber of Commerce of Lyons to the Paris Exhibition, and President of the Jury in the Silk Section, has written to the

Government of India, asking for information on the following points, not only as regards the tasar worm but also as regards other undomesticated worms:—

- (1) an enumeration of the different kinds of wild worms ;
- (2) the districts from which each kind is obtained, and in what quantities ;
- (3) the species of worm from which each kind of silk is manufactured ;
- (4) the trees on which the worms feed ;
- (5) the uses to which the silk is put by the natives ;
- (6) the markets where they are to be purchased ;
- (7) the probable prices of dry cocoons of each kind and of the silk as reeled by the natives ;
- (8) the probable quantities retained for local consumption and available for exportation to European silk mills ; and
- (9) the out-turn in money value of the silks woven in India, which M. Rondot thinks must be considerable, especially if tasar and other similar silks commonly worn by the natives are taken into account.

13. M. David, of St. Etienne, also asks for information on the following points:—

- (1) the nature of the chemical agent used by natives to soften the cocoon ;
- (2) whether the natives can reel a cocoon more than a year old ;
- (3) the length of time elapsing from the spinning of the cocoon and the emergence of the moth.
- (4) whether the dark and light colored cocoons which are found mixed in the bales sent from India are of different varieties, and whether they are found in the same localities ;
- (5) also, whether it would be possible to obtain bales containing only light-colored cocoons.

14. Some information, but of a vague and general kind, exists on a good many of the points enumerated by M. Rondot, and the Governor-General in Council desires that an effort may be made to cause such specific information as is obtainable with

special reference to the quantity obtainable and the prices on the spot, to be furnished with as little delay as possible. It is also much to be desired that particulars of manufacture should be obtained as far as possible.

The particulars of the out-turn of the filatures in Bengal are unknown; for, though the quantities exported and their values are ascertainable, Government is unable to say how much of the out-turn of the filatures (there are a great many native filatures) is kept in the country, or what it is worth. Of the small local native reeling (small separately, but large in the aggregate), no more is known than of the handloom village weaving of cotton. In Assam and Burma, silk reeling and weaving are a domestic occupation of the women of the house; in other provinces it is a trade. In Bombay, there are two mills worked by steam in which silk is woven, but the extent of their operations is unknown. In short, no precise statistical account of the silk industry in India is extant, though there is a good deal of information of a more or less vague and general character. As regards silk production, Mr. Geoghegan's account of silk in India contains practically all the information that Government possesses, although for some years past much attention has been paid to the production of tasar silk. The same is to be said of the other kinds of wild silk. These are all separately distinguished and shown in Mr. Geoghegan's book, in the section given to the wild silk producers, as well as in the Appendix by Captain Hutton. Interesting information, though in most cases of a general character, has been furnished by the Local Governments and Administrations, but more precise information is now desirable, and the Government of India will be glad if the Government of Bengal and the Chief Commissioners of the Central Provinces and Assam will take measures to collect it, and furnish a report giving a categorical reply to the enquiries of both M. Rondot and M. David.

From the Secretary of State for India, to the Government of India, No. 61 (Revenue), dated 29th August 1878.

Referring to my predecessor's despatch No. 25 of the 22nd March 1877, I now transmit, for your Excellency's information, copies of the first part of a further report by Mr. Thomas Wardle on tasar silk and Indian dye-stuffs, and of a memorandum thereon by Dr. Birdwood, C.S.I., together with the samples of silk referred to in the report; and also copies of a letter from Mr. Wardle, of the 31st July last, and of its enclosure, relative to an offer by M. David, of St. Etienne, to purchase 2,000 kilogrammes of tasar cocoons for the purpose of making manufacturing experiments at his own cost.

2. With regard to this latter subject, Mr. Wardle has been informed that M. David should be advised to procure the cocoons he requires in the ordinary course of trade through some firm in Bombay or Calcutta. I desire, however, that the information which M. David wishes for, relative to the native method of dealing with tasar cocoons, &c., may be procured and transmitted to me at an early date for communication to him.

3. It seems impossible to attach too much importance to the improvements introduced by Mr. Wardle in the manufacture of this silk, the results of which may confidently be expected to open up a large field of enterprise for the supply of this article to the European markets, and to bring into more extended use one of the raw products of India for which there has hitherto been but a limited demand.

4. I shall address your Excellency further on this subject upon receipt of the second part of Mr. Wardle's report.

Memorandum by DR. GEORGE BIRDWOOD, C.S.I., dated 10th August 1878, on MR. T. WARDLE'S Report on Tasar Silk and Indian Dye-stuffs of 1st August 1878.

It would be difficult to speak too highly of the patience, ability, and perseverance with which Mr. Wardle has carried out these experiments, or of the importance of the results ob-

tained. These are, in brief, that he has succeeded in preparing Indian wild silk almost as fine as the finest Chinese silk, and in dyeing it almost any color.

Whereas 1,000 yards of Indian wild silk formerly weighed from 10 to 15 drachms, it can be now prepared of the weight of only 3 drachms and under, the same quantity of the finest Chinese silk weighing 2 drachms to 4 drachms. In dyeing this wild silk Mr. Wardle's success has hitherto been chiefly with the aniline dye series. The defect of these colors is that they are crude, flaring, and inharmonious, but a process has been suggested to Mr. Wardle by which it may be possible to dye silks and other stuffs with the aniline series in rich, deep and artistic tones. I would suggest that Mr. Wardle's paper should be communicated at once to the Government of India. The portion of the report still due from him, on the application of the native dye-stuffs of India to Indian wild silk and other woven fabrics, will be principally of artistic interest. The present report is of very pressing practical interest, as M. David's letter shows. For nearly 100 years the Indian Government went on endeavouring to increase the export of Indian silk by importing eggs from China and mulberry trees and export labor from France and Italy and elsewhere, but all in vain. Even after the abolition of the Company's trading monopoly the same false and costly course was pursued, until in 1858 the attention of the Government of Bombay was officially drawn to the wild silk of the country, undoubtedly originally derived from China, and thoroughly acclimatized. Beyond ascertaining that wild silk was produced all over the Bombay Presidency, nothing was then done by Government. But Dr. MacKenzie and Captain Coussmaker and others continued to give great attention to the subject, and the result of their enthusiastic labors, combined with Mr. Wardle's long interest in their researches, has been to lead to the experiments now reported, which afford a substantial ground of hope that a staple may have at last been added to the export trade of India. In fact if the results of Mr. Wardle's experiments are confirmed, he will have succeeded in making Indian wild silk merchantable wherever silk is woven and worn.

As to M. David's letter, it may be submitted to the Government of India; but probably the better plan, in his own interest, would be for him to write to some firm in Bombay or Calcutta to send him direct the 2,000 kilogrammes of cocoons he wants.

When the second part of Mr. Wardle's report on the native dye-stuffs of India is received, it might be desirable to make a comprehensive report on the whole subject of those experiments.

MR. WARDLE'S *Report on Tasar Silk and Native Dye-stuffs of India.*—(*First Part*). Dated *Leek*, 1st August 1878.

I HAVE completed the first part of my examination, and have now the honor of laying the results before the Government of India.

Last winter I received a communication from Dr. Birdwood, asking me to undertake the arrangement of exhibits of Indian silks and dye-stuffs in the India Section at the Paris Exhibition.

I have done so, and the results of those exhibits form the basis of this report, especially that part which relates to the tasar and other wild silks of India.

I have not had sufficient time to examine all the dye-stuffs of India which were sent to me. In a few months the examination will be completed, and will form the substance of my second report.

In dealing with the tasar cocoons sent to me, I have endeavoured, with signal success, to improve the manufacture of this silk.

This has been accomplished to an extent that will greatly increase its importance in the silk industry of Europe, as well as making it much less unyielding in its resistance to tinctorial matters.

Much of the import of tasar silk is of such low and badly reeled quality as to be totally unfit for nearly all European textile work; and even where the quality happens to be better than it usually is, it is much too coarse in thread for any but

the coarsest kind of work; consequently its use is and has always been extremely circumscribed.

I shall be able to shew that there is no longer any necessity for this, nor for any obstacles to be interposed for the extended use and cultivation of this silk, and that it promises to be as useful in degree as that of the mulberry worm.

I believe also that the same may be said for several other species of Indian wild silks.

Several of the samples to illustrate this accompany my report; the rest, including the dyed specimens, are under exhibition at Paris, but shall be described here.

I have given the samples now sent the same numbers as those in the Paris Exhibition case. The report will, therefore, correspond in numbering and explanation with the monograph I have written, and which is appended to the second edition of Dr. Birdwood's Handbook of the Indian Section.

Nos. 8 and 9 are samples of tasar, organzine, and tram, illustrative of the quality and state of manufacture such as is now used in England for weaving, and a good representation of the present state of its manufacture, which gives a size of 255 deniers (15 drachms per 1,000 yards). The sizes of tasar generally used in England run from 152 deniers (9 drachms) to 255 deniers (15 drachms). These are very coarse sizes, and must necessarily be unfit to produce such fine textile work as the mulberry silk, which can be and is manufactured into organzine and tram of 21 deniers and upwards ($1\frac{1}{4}$ drachms), and from which are made the finest silk fabrics.

Nos. 13 to 17 are samples reeled for the market by the natives from the cocoons in various parts of India. They shew the more or less rude and imperfect states in which it is prepared for the market and for native use.

I send them only to point out the contrast between them and the next sample, 17a, which shews what, under proper management, this fibre is capable of. This is raw tasar silk reeled from the cocoons I received from India.

In September 1876 I proceeded, with your permission, to Italy with some of the cocoons, to have my ideas of cocoon-reeling and throwing carried out (cocoon-reeling being a branch

of silk industry not practised in England), and I am glad to report that I there met with the success I anticipated. The house which I employed to make the experiments Messrs. Gaddum and Company, were so much impressed with the importance of the results as to say to me they would send out to India a person for the purpose of collecting tasar cocoons on their own account.

I have subsequently heard of their interesting themselves in this manufacture.

This sample, 17*a*, is raw silk as wound from the cocoon, the fibres of six cocoons being wound together, forming one thread ready to be thrown into organzine or tram in the usual way, and capable of yielding sizes of from 51 deniers upwards, *i.e.*, 3 drachms and upwards, per 1,000 yards.

In addition to this greater fineness of thread, as compared with that of the present tasar silk of commerce, you will notice an almost entire absence of lumps, technically called "foul slubs," which have hitherto prevented tasar silk being substituted for the mulberry silks.

So that instead of organzine and tram of 15 drachms to 9 drachms per 1,000 yards, you have before you the improved silk capable of yielding organzine and tram of 51 deniers, or 3 drachms per 1,000 yards skein, and this with a silk primarily so much thicker in fibre than the mulberry silks.

At the end of the report, I have added a table of microscopic measurements which I have made of the thickness of the primary fibres of the mulberry silks (China, India, Italy, France, Japan, and those of the tasar and other wild silks of India). From this it will be seen that tasar silk is from three to four times thicker in fibre than the mulberry silks.

Tasar silk possesses the greatest strength and tensile power, and it has as much lustre as any silk.

No. 19 is a sample of tasar organzine (51 deniers or three drachms per 1,000 yards) manufactured in Italy from the cocoons under my own instructions and superintendence. The improvement in quality, fineness, and cleanness will be seen to be most marked, and that, instead of the coarse sizes of tasar now used, of 152 to 255 deniers (9 to 15 drachms), there

may be obtained by proper management organzine and tram of excellent quality from the same cocoons of 51 deniers (3 drachms) and upwards, which can be woven into a great variety of stuffs, for which until now only the mulberry silks have been available.

The attention of all interested in, or connected with, silk manufacture cannot be too strongly drawn to this fact, nor can its value be overrated.

There is a most important future in store for the tasar silk industry, and as great improvements will take place as those which resulted from the introduction of proper machinery and skill many years ago in the mulberry silk district of Bengal, when it was found that Bengal silks, in place of being then almost unworkable, could be manufactured in such a way as to bring them into extended use in Europe, so as even to rival French and Italian silks. The cost of making organzine and tram from the cocoons with the improved mode is about 20 francs per kilogramme—10 francs for reeling and 10 francs for throwing.

You will observe from the samples, and from what I have just stated, that the success in improving this manufacture is complete, and that tasar silk, when properly made, is ready to take its place in all the silk textile industries where extreme fineness is not required, such, for instance, as cloths of which a material is all tasar, or mixed cloth, with tasar weft, for trimmings, braids, elastic boot webs, where silk of 3 to 6 drachms is in constant use, also for the weft or shute of ribbons, the chief obstacle to its use hitherto for this last purpose having been its foulness (slubbiness). Now this imperfection is removed, there will be an extensive demand for it in the ribbon trade.

The difference between the ordinary tasar, selling with difficulty at 3s. to 4s. per lb., and the samples I submit is due to improved methods of manufacture, which I am ready to communicate to you, and even to teach to the native workmen if that course is thought more useful.

In the meantime, however, I would strongly urge that the greatest encouragement be given to the proper gathering and

collecting of tasar cocoons, and the exportation of them in a compressed state, and that encouragement be given to the planting and cultivation of the most suitable trees and plants which feed the tasar worm in the likely labor centres near good roads where the cost of carriage can be minimized.

The worm feeds on the following trees and plants :—

Rhizophora calceolaris, Linn.

Terminalia alata glabra. (Assun tree.)

Terminalia tomentosa. (The Saj tree.)

Terminalia Catappa. (Country Almond tree.)

Tectona grandis. (Teak tree.)

Zizyphus Jujuba. (Bér tree.)

Shorea robusta. (Sál tree.)

Bombax heptaphyllum. (Semul.)

Careya spherica.

Ricinus communis. (Castor Oil plant.)

Cassia lanceolata.

I am quite sure that a very largely increased production of cocoons will meet with a ready sale, especially in France and England. Even the unwindable and pierced cocoons and waste will have a ready market, since our spinners, as I shall shew further on, can utilize all such refuse, and make excellent yarns and cloths from them.

I may mention that I took the opportunity, whilst on the jury of the Paris Exhibition, to draw the attention of M. Colcombet, a juror, and M. David, two of the largest manufacturers of ribbons in St. Etienne, to the improved tasar. After thoroughly inspecting it, they said that if the Government of India could enable them to obtain cocoons, or point out how they may be obtained at about one franc per kilogramme, they would buy all that India produced, so certain were they of finding a ready sale and extended use for this, in place of the more costly silks.

M. David has since written to me asking me to obtain 2,000 kilogrammes (4,400 lbs.) of tasar cocoons for experiment. He says many uses may be found for well reeled tasar, the only important question is that of an economical means of doing so.

These economical means are at hand; for in place of the ordinary mode of reeling and throwing silk from the tasar cocoons into organzine and tram, which costs about 35 francs per kilogramme, or 12s. 8d. per lb., it can be done by the improved mode at about 20 francs per kilogramme, or 7s. 3d. per lb., and this cost will be decreased when the cocoons are properly collected and the industry better regulated.

Not less important than manufacturing is the dyeing of tasar silk, in the investigation of which I have been so long engaged.

I am happy to be able to report that the dyeing of this silk can now be successfully accomplished in all shades of color.

The results I have exhibited at Paris in three grades. The first consists of organzine and tram of the same coarse quality as at present used in England for weaving into self-colored dress pieces, dyed in a variety of reds, blues, greens, yellows, and tertiary colors, with the dye-stuffs native to India, and with which I was furnished by the Government of India for examination.

An exposure of upwards of two months to the sunshine of Paris has only very slightly affected them, although placed in a position exposed to the direct rays of the morning and mid-day sun. The colors are not of the vivid intensity and crudeness of those produced by the aniline dyes, but they possess more tone, and are fitter for all purposes of true decorative art, and possess much more permanency: but on those points I hope to treat more definitely when I have the honor of presenting my report on the dye-stuffs of India, and their applicability to tasar silk, at present under examination.

By the advice of Dr. Birdwood, I also exhibit tasar silk dyed with ordinary aniline dyes, in order to shew what could be done on it with these dyes, which in Europe have almost replaced the better and faster materials. I have, therefore, dyed two grades of tasar organzine in a variety of delicate shades of aniline dyes—one, the second, is the improved organzine, the third is ordinary tasar organzine of good quality.

In dyeing the *improved* organzine, a very important fact appears. The silk takes the dyes with less difficulty. I have

no doubt that one of the main reasons why the natives cannot dye tassar silk will be in the fact that the methods of their rude manufacture partly destroy whatever affinity such silk has for tinctorial impregnation.

It is not unlikely that before tassar silk can be really well dyed in India, a considerable improvement must be effected in all the manufacturing operations, even from the time the cocoon becomes completed.

It would, perhaps, be hardly within the scope of this Report to go into the chemical reasons for this opinion, but they are no less important than real.

I have also to report similar success in applying printed colors upon tassar silk cloths, samples of which I send with the Report Nos. 21 and 25. It is, as far as I am aware, the first time any attempt has been made, either in Europe or in the East, to print on wild silk cloth of any kind.

So that now printed tassar silk can be successfully used for wall damasks, curtains, furniture coverings, hangings, women's and girls' dresses, with great effect, and I would draw the attention of upholsterers and broad silk manufacturers to these specimens, and especially three under No. 55 of twill silk, made of this material from the warp and weft of Nos. 8 and 9, 255 deniers.

The fabrics made of tassar silk are very strong, most durable, and possess much lustre. The patterns printed in blue are the first successful application of indigo on silk as a print, and not as a pencil blue as formerly.

The tone of blue is very rich, modified to some extent by the natural ground color of the silk (which is fortunately incapable of being made vividly white), and has consequently controlled too great a brightness.

They will prove remarkably fast; in fact none of the colors are printed in aniline or any other fugitive dyes.

These fabrics are woven with organzine and tram of the coarse native-reeled and English-thrown tassar of 15 drachms per 1,000 yards, and are not really such good examples of what

can be done in printing on fabrics of improved manufacture, samples of which I hope, before long, to submit to you, but they effectively serve the purpose of showing that now a great variety of colors can be applied to tasar silk fabrics in printing as well as in dyeing, and I cannot conceive of any more beautiful application of them than to the walls of rooms after the manner of damask, if well designed.

I come now to treat of spinning tasar silk. This is effected after the manner of spinning cotton, wool, flax, or any other short fibre that cannot be wound off in a continuous thread.

Since the important improvements which have been made in England of late years in silk spinning machinery, a new and large industry has sprung up whereby all refuse silk and unwindable cocoons of the mulberry silk manufacture are submitted to the operations of carding, combing, and spinning, and threads of beautiful regularity and silkiness are made.

I have exhibited a series to show to what uses the waste of tasar silk and the cocoons pierced by the exit of the moth can be put after being spun in this way.

There are probably not less than forty firms in England engaged in this operation, and many more in Switzerland, France, and Italy, but it is only recently that tasar waste silk has attracted notice, and large quantities have been a drug in the market for a long time. They have been bought up, and have been spun and woven into fabrics for upholstery and dresses of surprising perfection and interest, and a demand which cannot be fully supplied has arisen for a further supply.

I send sample No. 56a which I have had spun and woven from unwindable cocoons out of those I received from India; also five samples, No. 57, made of tasar waste and printed in colors.

Also samples of yarns spun from tasar waste for weaving, sewing and knitting stockings.

Probably of not less importance in the future are the other wild silks of India, particularly that of the Arrindi or Eria worm of Assam, known under the following names:—

Phalena cynthia, (Roxburgh).

Bombyx cynthia, (Oliver).

Samia cynthia, (Hübner).

Saturnia cynthia, (Westwood).

Saturnia Arrundi, (Royle).

The *Arrindi* or *Arrundi* silk-worm moth (Roxburgh).

With this I must connect the *Attacus ricini* (Boisduval), the same insect, as far as I can gather, except that it is fed on the *Ricinus communis*, or Palma Christi plant, and is reared in a domesticated state in Assam, and over a great part of Hindustan, more especially in the districts of Dinagepur and Rangpur.

Mr. Hugon gives the following interesting particulars about it:—"The larva, when at full size, is about $3\frac{1}{2}$ inches long. It spins its cocoon in four days. The Hill tribes settled in the plains are fond of eating the chrysalis."

The cocoon is much smaller than that of the tasar, and is soft. The natives cannot wind the silk, but spin it like cotton. Dr. Helfer says that the insect is so productive as to give sometimes twelve broods a year, and that the worm grows rapidly, and offers no difficulty whatever for an extensive speculation.

Mr. Atkinson says the filament is so delicate as to render it impracticable to wind off the silk; it is therefore spun like cotton. The yarn thus manufactured is woven into a coarse kind of white cloth, of a seemingly loose texture, but of incredible durability, the life of one person being seldom sufficient to wear out a garment made of it.

The winding of the *Eria* cocoon is said to have been recently accomplished. The thickness of the *Eria* filament is 1—3,800 of an inch.

Leaving the question as to whether it be successfully wound or not, one important consideration respecting its use presents itself, namely, its capability of being spun like cotton or wool. The great improvements made in late years in England in spinning machinery have proved that marvellous results in making an even thread from waste silk and unwindable cocoons for sewing and weaving purposes may be attained, and I will venture to predict a future for this, and the produce of all unwindable silk-worm cocoons that will compensate for collection.

The industry of the natives should be stimulated to the gathering in of all kinds of wild silk cocoons, whether windable

or not, for there is no doubt that those kinds which cannot be wound can be most easily spun, and there is at the present moment a request on the part of silk spinners for a larger supply of tasar silk cocoons and tasar silk waste for spinning purposes, and no doubt other silk cocoons would be gladly bought up.

A worm so prolific and yielding such exceedingly fine silk gives a large promise of future supply to the spinner. I should be glad to have your authority for a further and thorough effort to make silk marketable in Europe.

Besides the *Eria* worm there are also the following which furnish good silk cocoons, all of which I have exhibited in Paris :—

The *Attacus atlas*.

The Mooga or Moonga silk (*Antheræa Assama*) giving five broods a year. I send a sample of this silk, No. 35. It promises to be useful silk under proper care.

The *Bombyx attacus*, "Yama mai," a native of Japan, but found in India. In Japan the silk of this worm is said to be most highly prized, and reserved for the use of royalty, but this I am inclined to doubt, as the silk is of a coarseish character. This I was assured by the Japanese at the Paris Exhibition is not now the case; they showed me several highly interesting fabrics made with it. The cocoon is of a beautiful pale green color and is easily wound. It has been reared in Europe, and a cross between it and *Bombyx Attacus pernyi* is a success in France, being so hardy that the eggs will hatch at freezing point. A successfully encouraged cultivation of it in India would make a valuable addition to our Eastern sericulture.

The thickness of the fibre is 1—950 part of an inch, being a little finer than tasar silk. It is also very much whiter in color, which is an advantage for dyeing.

In addition to these are the following :—A silk called "Yabaine," from Prome, in Burma, Pat silk from Assam (*Bombyx textor*); Mezankuri silk, rare; *Actias Selene*.

In Simla, Balfour states there are eight or nine species of *Bombyx*, probably all silk-producers.

I plead for the utilization and extended cultivation of all these wild silks, particularly the Tasar, Mooga, Eria, and Yama mai.

The difficulties of manufacturing, dyeing, and printing are, I am thankful to report, overcome.

It only remains for the Government of India, if I may presume to urge it, to give that encouragement and constant support to the increased production of the wild silk industry of India, and not to the wild silk only, but also to the mulberry silk, that has for centuries been accorded by Sovereigns and Statesmen in France to the permanent establishment and encouragement of the silk trade in that country, to make India a chief exporter of raw material, as France now is of the manufactured products.

The following table contains the series of microscopic measurements to which I referred in the earlier part of this report:—

Microscopic measurements of the diameter of the primary Fibre of Tassar Silk and other Silks.

NAMES OF SILKS OR WORMS PRODUCING THEM.		MEASUREMENTS OF THE DIAMETER OF THE PRIMARY FIBRE.					
Scientific names.	Vernacular names.	Country.	Food of larva.	French metric scale.		English scale.	
				Loose silk on outside of cocoons.	Silk forming substance of cocoons.	Loose silk on outside of cocoons.	Silk forming substance of cocoons.
<i>Bombyx mori</i>	...	China	Mulberry	Mm.	L Mm. .0125	Inch. 1/100	Inch. 1/100
" " white	Japan	"	.....	.0135	.....	1/75
" " yellow	Bengal	"	.....	.006	.....	1/165
" "	"	"0068	.....	1/145
" "	Bruttia, Asia Mi-	"	.....		.....	1/155
" "	nor.	"	.....	.0115	.....	1/85
" "	Bengal	"	.....	.01	.....	1/100
" "	Italy	"	.....	.0108	.....	1/90
" " <i>texia</i>	France	"	.....	.0135	.....	1/75
<i>Attacus vorni</i>	Assam	"	.....	.01	.....	1/100
	India	"	.....	.006	.....	1/165
		<i>Ricinus communis</i> , Castor oil plant.	.016		.....
		Soom and Sonba-	.0185		.....
<i>Antheraea Assama</i>	Assam	loo trees.		.01	.....	1/100
	Beerbhoom (Ben-	.....	.01	.006	.....	1/165
	gal.)	Terminalias and	None.	.03125	.....	1/30
<i>Antheraea Paphia</i>	India	other plants.			.....
<i>Bombyx</i>	Sibsagar (Assam.)	Mulberry	.....	.01	.....	1/100
<i>Acacus Selene</i>	India	Coriaria Nipalen-	.03	.02	.....	1/100
<i>Attacus Atlas</i>		sia.	.03	.02	.....	1/100
		Phyllanthus em-			.....
		blia.			.....
<i>Bombyx Attacus</i>	India	The oak	.025	.026	.....	1/100
" <i>Perryi</i>	China	"	.....	.025	.....	1/100

*From MR. WARDLE, to the Under-Secretary of State for India,
dated Leek, 31st July 1878.*

Since writing my report I have received from M. David, who, I am told, is the largest silk manufacturer at St. Etienne, an order for 2,000 kilogrammes of tasar cocoons, for the purposes of making manufacturing experiments with this silk at his own cost.

I enclose a translated copy of part of his letter.

Will you have the kindness to inform me if the Government of India will authorize the collection of the cocoons, and supply them to M. David with the information he desires?

I have no opportunity of obtaining them for him.

Copy of a letter from M. DAVID, of St. Etienne, to Mr. WARDLE.

I offer to buy one to two thousand kilogrammes tasar cocoons delivered at Marseilles at one franc per kilogramme; these cocoons to be of the year's crop and well killed, not pierced. Kindly impress on your Bombay friends to kill the worms in the cocoons well. In case the moths come out on the road, the cocoons will be useless. A friend of mine has just received a bale of these cocoons and the moths came out of them at Marseilles.

In order to facilitate the reeling in France, kindly give me the following information:—

1st.—What is the chemical agent made use of by the natives to soften the cocoon and make it ready for reeling?

2nd.—Can the natives reel a cocoon more than a year old?

3rd.—What is the length of time elapsing from the making of the cocoon and the time of the coming out of the moth: does not that time vary greatly?

4th.—The cocoons in the bales are mixed in color, dark and light: are these different varieties, and are they found on the same spots? Would it be possible to get only light-colored ones?

I shall be thankful for answers to the above questions, which will facilitate my task.

Many uses may be found for well-reeled tasar. The only important question at present is that of an economical means of so doing.

III. REVIEWS

Journal of Forestry and Estates' Management.

ACCORDING to our custom we proceed to review the numbers which have appeared since our last issue.

The number for MARCH 1879 quotes the effects of the severe winter in England, and the exotic species that succumbed to it. Australian trees suffered most, including those of New Zealand; *Eucalyptus* suffered, *E. amygdalina*, *polyanthemos* and *viminialis* proving the hardiest. North China and Japan trees generally escaped. It is said that Himalayan trees and shrubs suffered, but "many fine things from that region have proved quite hardy, especially amongst the rhododendrons and allied plants."

Mr. Ellison (County Durham) contributes a paper on the "Proper season for gathering seeds of coniferous trees." The gist of the matter is to wait till the seed is fully ripe, and about to drop of itself, the gathering being so arrayed as just to forestal the dropping. Self-sown seedlings, larch, pine, &c., are worth each a score of planted ones.

Mr. BARRY gave us the 5th part of his previously noted "French Forestry at the Paris Exhibition." Mountain *reboisement* not being a thing which an English forester has ever had much to do with, and the vital importance of which does not strike him as it does a Himalayan forester, the account Mr. Barry gives is rather bald. He does not seem to realize what a torrent is—and is rather indignant at the "Herculean" outlay of labor on the torrent of Bourget (Basses Alpes) which he speaks of as if it were a mere mill-stream, and which "threatened the village of Bourget."

Otherwise the account is an abridged notice of M. Thelu's paper, a more extended translation of which was given in the INDIAN FORESTER for January 1879.

A good paper on "Tree Seeds, Seed-beds and Sowing," by Mr. A. Burrows, one of the best contributors to this journal,

should be read. Mr. Burrows discusses the question whether it is right to raise plants in highly manured and rich soiled nurseries when you expect the trees to grow ultimately in places where the soil is poor, or at all events, when there is no such special nourishment available. The author thinks that the nursery should be well worked and sufficiently rich to ensure a good growth, and so make a plant with abundant vitality and good form in it, to put out withal. He says: "Nobody thinks of starving the lamb or the calf, because in years to come the ram or the bull may have to provide for himself upon a pasture, poorer than the one on which he was reared." The author's remarks on care in *harvesting seed* are excellent.

Those who want to hear about some remarkably large trees may next read Mr. R. COUPAR's note.

Mr. Gordon's (3rd Part) "Notes on Trees" is devoted to telling us how far Sir Robert Christison has exploded in an article in the Transactions of the Edinburgh Botanical Society for 1878, the DeCandolle theory and formula for computing the age of standing trees.

Mr. Gordon has no difficulty in telling the age of a tree when it is felled, but how to do it when it stands alive, he cannot say, and all through the paper he tells us how desirable it would be if we could tell, but he gives no suggestion of any true method, except, to count the rings in as many *felled* trees as possible that grow in similar soil and conditions, and compare the size of the trees, so measured, with the dimensions of the standing tree. This we have, we think, heard before.

But what follows is worth noting. Mr. Gordon points out that when the width of the annual rings has diminished at a certain stage of growth it does not follow that the timber-producing powers are becoming exhausted. A layer of wood half an inch thick, encircling a column (of previously formed timber) six inches in diameter at the ground and tapering to a quarter of an inch at 25 feet does not exceed in cubic content that of another layer one-eighth of an inch thick, and which envelopes a column 12 inches at the ground and tapering to a quarter of an inch at 50 feet.

Amongst "Notes" will be found an account of Messrs. BARON'S transplanting machine, which lifts and carries away large trees 30 feet to 50 feet in height.

The APRIL number gives justly a wail over the 27-acre Arboretum, bought by the city of Edinburgh and given free to Government; the latter have fenced it in with a stone wall and iron railing (which is not altogether effective) and there they stopped!

In the province of Auckland (New Zealand) last year seventy million cubic feet of Kauri (*Dammara australis*), were, the Editor says, cut down for home and foreign trade. We hope that the forests which yielded this are in a condition to reproduce it.

In this number there is a further article devoted to Baron's transplanting machine; and this time with a diagram. The whole apparatus is not likely to be useful in India, but it is very interesting; the machinery is all arranged on a frame which can be taken to pieces, and is mounted on wheels. This is got in position with the tree stem in the middle, so that when the tree is raised planks are put under, and the whole thing, tree and all, is wheeled away; on the frame are stout rollers which gradually wind up stout chains, the ends of the chains being well fastened to very strong planks which are passed through the ball of earth in which the main roots of the tree stand, and which has been, of course, exposed, by digging away the earth in a trench all round.

There is a brief and interesting note about the Snow Storms in Scotland, February 1878, and the conclusion of the "Remarkable trees in Scotland" should be read.

"The Forests of the United States" are up again. The Secretaries, and everybody else, seem really to be of opinion that "something ought to be done, you know," but why on earth does somebody not *do* it?

People interested in *Wellingtonia* culture will find a detailed paper (without signature) on the subject.

The "Country Gentleman" has given a note which the "Journal" copies—on the *Spiræa Lindleyana*, and thinks that it is first-rate for introducing on to lawns, &c. Our readers

will remember that the species, or one *very* closely allied to it, is the *Spiræa* with the pinnate leaves and large panicles of whitish flower, so common in all our upper hills (above 6,000 feet.)

We extract among our "Notes and Queries" an interesting notice of the Forests of Herzegovina and Bosnia, taken from this number; also a notice of the Cork oak which many of us have seen in the Garden of Fulham Palace, near London.

THE MAY NUMBER.—We commend to notice an editorial on the subject of the New Forest and the Act of 1877, which appears to have had the worst possible effect. The Province of South Australia passed an Act in 1878, giving the Governor power to proclaim and determine Forest Reserves, and appoint officers for their management. The Act makes provision for encouraging the planting of forest trees by private owners. A reward of two pounds per acre to be paid if the plantation is not less than 5 acres, and if in strips 100 feet wide, the trees not to be planted less than 16 feet apart. The trees may not be cut down before they are *five* years old (!) Such provisions are of no kind of use; but they look nice to people wholly ignorant of forestry. What possible benefit could it be to the public (who pay £2 per acre) to have a whole lot of little groves planted out *first* at 16 feet apart (!) and all to be cut down if the owner chooses at *five* years old (!!)

Mr. Burrows has a paper on "Limes and Limestones." Calcium and lime, however, are not the same thing as Mr. Burrows seems to think. Calcium is a pale yellow, malleable and ductile metal obtained by electrolysis from various calcium-chlorides, nitrates, &c. The paper is, however, well worth reading.

Mr. Barry concludes his notes on the French Exhibition, describing here the "Implement Department."

A flying timber slide, made of ropes crossing a ravine 265 feet wide, designed by M. Viard, Inspecteur of Bayonne, is justly noticed.

A dendrometer is noticed, which is designed to give the height of the tree and the diameter at any given point inaccessible.

There is also a little machine for counting trees, the count being taken by pressing a button. This is a design of M. Levret,

and costs about £2. There are numerous planting tools and seed-sowers, descriptions of which without drawings are uninteresting.

The whole of the French forests cover, says Mr. Barry, 22,718,333 English acres, that is, 17 per cent. of the total area of the country. Comparing this with other countries:—

France has	17 p. c.	of forest.
Germany	34 p. c.	"
Austria	31 p. c.	"
Norway	48 p. c.	"
Sweden	42 p. c.	"
Russia	43 p. c.	"
England and Wales	2 p. c.	"
Scotland	4 p. c.	"

With Alsace and Lorraine France lost 247,000 acres; otherwise the forests have not been seriously diminished since 1834. But before that there were enormous sales. In 1795, the State forests were $2\frac{1}{2}$ times in extent what they now are.

Mr. S. Neil contributes a paper on the "Timber Trees of Classic Times" well worth reading. The varieties of oak are dealt with, and the author promises to continue the subject in a future number and tell us also about other trees.

Sir Robert Christison's paper on the "Exact Measurement of trees and its applications" is in this number given *in extenso* from the Transactions of the Edinburgh Botanical Society. The object is to controvert the position of De Candolle ("Physiologie Vegetale," ii. 974) that after a certain number of years of rapid and irregular growth, the diametral increment of the trunks of trees is uniform, or very nearly so, to the extent of their lives, if the measure be taken by decades of years and not annually to avoid irregularities occasioned by differences in the geniality of the successive annual seasons of growth.

Besides controverting this, the author desires to enforce the importance of accurate *girth* measures, and points out how useless they are without a specific determination of the height at which they were taken. Five feet from the ground is usually the only suitable point for measuring. We must, however, take care to keep clear of the swelling caused by buttresses or roots

spreading, as well as that caused by the offsetting of large branches.

The Scottish Arboricultural Society, we see, before closing this number, are busy as usual. Twenty-five medals are offered as rewards for essays and reports on all kinds of subjects—one for an "Approved report on the forests of India." Why not of the world? The forests of *India* are far too large and diverse to be treated of in anything but a very unsatisfactory way as a whole. We shall also be anxious to see the "Approved report on the Management of Forests on the Continent of Europe." These wide, we might say enormous, subjects can never be properly treated in a report. To produce useful monographs of this class the subject should be *definite* and restricted.

"Glances at the Forests of Northern Europe."

We have received a pamphlet with the above title by the Rev. Dr. J. C. Brown. It consists of a reprint of the different articles which have appeared in the "Journal of Forestry and Estates' Management."

The papers exhibit the usual good qualities and defects which mark all Dr. Brown's writings. Great industry in accumulating materials, a most laudable and persistent diligence in getting at the bottom of things, and finding out everything to be known about them; but every paper shows a defect in method, a conspicuous inability to arrange material when collected; the consequence is that the result is rarely readable, and always fatiguing to the mind.

The opening sketch of Denmark is perhaps the least noteworthy in the book, and it stands in feeble contrast with the masterly and complete account of the Danish Forests which appeared in the "Revue des Eaux et Forêts" for February 1879.

Dr. Brown tells us nothing about the existing forests, but gives some interesting facts about the forest bogs of Denmark, which contain buried and carbonized trunks of now extinct forests.

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mains of oak are abundant, though oak is hardly known now-a-days. At a still lower level the Scotch Fir (*P. Sylvestris*) is found, although at no period in historic times has this species been known to flourish in the kingdom. This gradual supersession of one class of forest by another is very remarkable.

The sketch of Norway which follows is better as regards information. The species of which the forests consist chiefly is the Norway Spruce (*Abies excelsa*). It is chiefly inland and along the rivers that the forest is found.

"The forests in Norway are by no means so extensive as the frequent mention made in England of Norway timber may lead those who have never visited the country to imagine. They are generally found along river courses. They extend from half a mile to three or four miles from the banks of the river, and up the precipitous hill-sides beyond. Sometimes the continuity is broken abruptly on the river-bed by perpendicular cliffs; but the forest extends on the table-land above, like a dislocated geological stratum, or the further side of a dyke or fault.

"Many of the forests are private property; others belong to commercial proprietors. In both classes of forests the right to fell timber is generally let to contractors possessed of large capital, by whom arrangements for felling wood upon an extensive scale are made.

"Previous to the introduction, of late years, of an improved forest economy, the system of exploitation or working usually adopted was one intermediate between that known in France as *Jardinage*, felling only such trees as were desired, and that known as *à tire et aire*, in which the forest is divided into as many sections as periods required for the reproduction of the crops, and these are cleared in succession, but only one in each period: the *coupes*, or fellings in different periods in these Norwegian forests not being regulated in extent by precise measurement, but being determined by the convenience of the contractor, and only trees suitable for his purpose being felled. These are generally trees, on an average, a little under two feet in diameter; and all such are felled, leaving after them but a poor and scraggy crop of growing trees to replace, in course of time if they can, what has been removed.

"In Norway there is no lack of means for transporting the felled timber by water to the coast. In many places the felled trees, stripped only of their larger boughs, are tumbled into a mountain stream, to be by it borne to the nearest river or lake; in others, they are shot along artificially constructed slides, leading to some lake or river. These slides are in structure intermediate between the *chemins à trainaux* and the *lançoirs* or *glissoirs artificiels*, used in France. They are about 5 feet wide. Sleepers are laid across the line at about equal distances apart, and upon these are laid, lengthwise, trunks of young trees about 5 or 6 inches apart, and often so arranged that those at the sides are somewhat higher than those in the middle to form a groove of sufficient depth to keep the shot timber in the slide. In some cases these slides run directly down the declivity to the river or lake to which they are destined to convey the timber. In other cases, they run across the side of the hill in a slanting direction. In some places earth is removed to allow of the desired angle of inclination being secured. More frequently this is attained by the slide being supported at places by piles of earth or beams. When necessary, they are carried on supports across small valleys, or watercourses, separating the forest on the one side of a mountain from the forest on the side of another; and occasionally there may be seen their straight course altered by an angle more or less abrupt. At such places there is generally raised at the outer angle of the slide a bank against which the trees may strike in their descent and then recoil into the new direction: these by the new direction thus given to their course, go on, sometimes head foremost, and sometimes making first a complete somersault or revolution. In general also a workman, or it may be two, or even three, are stationed at these points with long poles to aid at the time the movement of any trees which might otherwise be in danger of sticking fast and blocking the way. The slides in general lead to pools of considerable depth in a lake or river. Into these the trees oftentimes descend more than their entire length, starting up again vertically before setting off anew on their course.

"Much *débris* is found all about such spots; but it is comparatively seldom that logs are seriously damaged. The quantity of

splinters may be, to a great extent, composed of the lesser branches left on the tree when placed in the slide."

But little thought is given to reproduction apparently.

"Many of the farmers are dependent on the cutting and sale of wood to enable them to pay their rent. The logs I found to be of but limited dimensions, and I asked the timber merchant if the exploitation adopted did not tend to devastate the woods. "Look," said he in reply, "there are young trees growing in every nook and corner down to the water's edge on both sides of the river, throughout the whole course of our voyage. And so is it for miles inland. As fast as we fell others grow." I called his attention to the small size of the logs, and told him of what was being done in Sweden and elsewhere for the conservation and improvement of forests; but he only laughed, as if that were a thing altogether unnecessary here, and one which it would be ridiculous to propose, and he called my attention to the floats of timber we were constantly passing."

The sketch of Sweden is unfortunately so much taken up with an account of the Forest School (all or most of which we have had before in other parts of Dr. Brown's writings) that there is no room apparently to tell us about the forest itself.

This is nearly all we hear:—

"The forests of Sweden are extensive, covering about two-sevenths of its entire area. The varieties of timber, however, are few. In the north the pine, birch, and fir are the principal trees; in the central parts the ash, alder, willow, and maple are also common; and in the south the oak, beech, elm, and lime are met with. In the plain of Scania the mulberry, chestnut, pear, apple, and walnut trees flourish.

"In Sweden, says Marny, a French writer on the forests of Europe, the woods are numerous, but little productive, and we only rarely meet with vast forests. Dalecarlia, Wermeland, and the district of Orrebro are the only central counties where arborescent vegetation attains sufficient energy to cover with wood a large extent of country. There the Coniferæ almost always constitute the basis of the forests. Sometimes, however, the birch replaces them, notably in Oster-Gothland. Sweden, like America and Siberia, has her forest fires, which deprive in a brief

time a whole forest of its shade; and vegetable life once destroyed revives only with difficulty on this frozen soil."

"In the diocese of Bergen the fir has still the gigantic proportions seen in the forests of Switzerland and Germany, but more to the north its size is diminished to stunted proportions, and at the polar circle it has totally disappeared; whilst in Swedish Lapland it advances yet to two degrees beyond it.

"In Sweden, of late years, strenuous and successful efforts have been made to introduce into the management of the forests the latest improvements in forest management adopted in Germany and France, and to regulate the national forest economy in accordance with the most advanced forest science of the day. In regard to the measures adopted, and the history of the movement from its commencement to the present time, detailed information is forthcoming whenever it may be desired and occasion serve."

The fourth "Glance" is at Finland, and here we are introduced to the method of forest destruction, which is practised here something like the "Kumri," "Jhúm," "Dhya," "Toungya," of India and Burma.

This is called an "antiquated treatment" of forests which in India "has been much condemned by officials in the Forest Service" ! !

A fifth paper on Northern Russian Forests brings the pamphlet to a close.

The author follows Mackenzie Wallace in his geographical division of Russian territory, and describes the "Forest zone" as extending in width for the whole breadth of Finland, and following to some extent the 60° parallel of latitude (the latitude of St. Petersburg) to the Ural Mountain. Below this come again Agricultural zones, and the "Steppe zone," beyond which again is the pastoral region to the north of the Caspian, the whole spreading in a fan-like figure as from a pivot in the latitude of 55° N. in Asiatic Russia.

Dr. Brown was just going to visit some of the *Northern* forests, (for the whole zone is a vast extent and different portions of it exhibit different features), when—he didn't go. Somebody came and gave him a pamphlet all about the forests, so that his journey was unnecessary. In this pamphlet we do

not hear much about the forests either. But Mr. Baeleff's "Fabrique" of forest products is noticed, and here they turn out tar—about 25 poods or 900 lbs. from a cubic fathom of wood, as well as 72lbs. of turpentine; using half a cubic foot of firewood in the process.

From a *square fathom* of birch (*sic*) they get 250 (?) *poods* of pyroligneous acid; that would be 9,000 lbs. English weight, so it is quite right to put a query to the number.

Unfortunately the works don't pay, the turpentine is bad and the acid is more than there is demand for.

The writer at this stage got a fine view of Lake Onega, there about 54 miles broad; and then got into the province of Olonetz, where, apparently, the country is one interminable forest of fir, pine, birch and aspen, the trees being of no great size. The total area of the province is a little over 14 million *desatins*, and of this 10 millions are forest.

There may be a fine future for the forests, and by the aid of sawmills erected in convenient proximity they may become a reserve of timber for all Europe. At present they are cut and burnt without care, because 'there is so much of it.'

The population is fortunately scanty, about 1 man to 47 *desatins* of land. Each man regards the wood as much common property as he does air or water.

But the forests are never ending.

"Proceeding onward to the north," says Dr. Brown's informant, "on both sides of the road there were to be seen forests and forests, and nothing but forests. I can affirm that the person who is acquainted with the extent of these forests by knowing only the number of *desatins* which they cover, has no idea of what that extent is. To obtain this, one must travel through them—travelling continuously through forests for five hundred versts; and he must experience personally the depressing influence produced by the forests and forest-covered mountains of this forest region, to enable him even partially to comprehend what is implied in the easily pronounced statement about so many millions of *desatins*."

The writer at last got to the shores of the White Sea, and seemed to be heartily glad to be out of the forests.

IV. NOTES, QUERIES AND EXTRACTS.

THE Old Cork Oak at Fulham Palace is believed to be one of the oldest, as it undoubtedly is one of the finest, cork oak trees in the country. The *Gardener's Chronicle*, in giving an excellent illustration of this unique old tree, thus describes it:—"The tree has passed its prime, having been planted at Fulham, probably by Bishop Compton, more than 200 years since. At breast height the tree girths about ten feet. It is a fine specimen, but needs the support of ivy-clad props. From the acorns numerous seedlings have been raised. The cork oak (*Q. suber*) is a native of Southern Europe and Northern Africa. When the tree is about fifteen years old its bark is removed by incisions in such a manner that no injury is done to the tree. After eight or nine years the process can be repeated. The outermost layers form the 'male cork,' which is of little value, except in the form of 'virgin cork.' After their removal new corky layers are formed in the denuded bark, which constitute the female cork, or cork of commerce. The tree at Fulham stands in the angle between the palace and the newly erected chapel, on the walls of which latter ivies of various kinds are placed, some of which have made extraordinary growth, especially the silver ivy."—*"Journal of Forestry."*

THE Surveyor-General of Natal reports that a tree of *Eucalyptus globulus*, twenty-five years old, was recently cut down in that colony (the species was introduced into the South African colonies many years ago) which yielded 700 cubic feet of timber, and realized nearly £20 for fuel. He adds that clumps of *Eucalyptus* planted in undrained swamp lands, at various elevations up to 4,000 feet, have been found to completely dry the space within reach of their roots. The growth

of timber in these situations is computed at twelve tons per acre per annum, while the annual growth of the vegetation which it superseded did not exceed $1\frac{1}{2}$ tons per acre.—*Gardener's Magazine*.

The Forests of Bosnia and the Herzegovina.

(From the "*Journal of Forestry*" and *Estates' Management*.)

THE greater portion of the arable soil in Bosnia and the Herzegovina is covered by forests, many parts of which are at the present moment in a most deplorable condition. A carefully prepared statement recently issued calculates, according to the *Boehmische Correspondenz*, the area of forest in Bosnia proper and in the Kraina to be 400 Austrian, or 2,400 English square miles, besides 150 miles of sterile ground overgrown with bushes and brambles; whilst the cultivated soil and pasture land is set down as 2,160 English square miles only. In the Herzegovina the preponderance of wooded and sterile ground is greater still. In that province the forest covers an area of 240 square miles. About 600 square miles are sterile ground, covered with undergrowth, wood, and heather, whilst the cultivated soil and pasture land amount only to 380 square miles. The total area of cultivated soil in both the provinces consists therefore of 2,540 English square miles, against 2,640 English square miles of wood and forest, and 750 square miles of heath and barren ground.

The immense forests were, up to the year 1850, considered by the "begs," or Bosnian nobles—up to that time all-powerful—as their exclusive property. Their influence, however, diminished visibly with the suppression, by Omar Pasha, of the revolt and insurrection of the nobles. They were deprived of many of their privileges, all the forests and woodland in both countries being in 1853 declared to be the property of the Sultan—i.e., State property. In the year 1865 the Turkish Government even promulgated some new forest laws, exclusively for Bosnia and the Herzegovina, in order to put a stop to the increasing devastation of the forests, and the depredations practised by the population living near any available road and in the neighbourhood of the rivers. A forest commission was

also instituted, and a chief inspector of woods and forests elected; but neither the projected reforms, nor even any systematical forest culture, have ever been carried out, though the laxity of the Government supervision has led to very mischievous results. Everybody in Bosnia and the Herzegovina was not only permitted to cut down and appropriate any quantity of wood required for household use, but even to bring it to the market and offer it for sale without paying any tax for such permission, or without requiring any license whatever.

The Government, however, demanded the *desetina*, or tithe, to be paid either *in natura* or in coin, upon all the timber required for other than domestic purposes. Firewood from the forests of Pale and Mokro—floated down the river Miljatzka—amounting to about 50,000 *tovar* (or bullock-loads) yearly, was also subject to the payment of the tithe.

But although the permission for such a free supply of wood was very much to the interest and prosperity of the population, the unlimited use that was made of such a privilege has led to some very injurious results. Great portions of the woods situated in the neighbourhood of available roads, and those near the river Save in the Posavina, and in the Kraina those bordering upon the river Unna, have become mercilessly devastated, not the slightest care being taken for the aftergrowth of the wood and its future condition. Neither did these extensive forests produce any revenues to the State until the Turkish Government entered into some contracts with foreign speculators, by which these parties—upon payment of some moderate rents—were permitted to cut timber and to clear the woods in certain specified districts of the two provinces. Even that, however, was practicable only within a certain distance (twenty miles at the utmost) from the rivers, as the transport over a longer distance would have considerably increased the expenses and diminished the value of the timber. Yet even this small gain has totally ceased since the outbreak of the insurrection in the Herzegovina and Bosnia, and the Turkish Government has for the last three years derived no revenues whatever from these colossal forests.

It must be a great satisfaction to the inhabitants of these countries and those interested in their welfare, that at last steps have been inaugurated to bring about some improvements, and to make an end to this unpardonable waste. Meetings of the more influential and industrious classes of the Bosnian community continue to be held in various parts of the country. Suggestions have been made, and have been freely discussed at such meetings, for effecting some alterations in the state of the forests—so shocking at present—also for stopping the remorseless devastation, and for creating a more practical utilization of the forest lands. They consider that now, after the occupation by Austria of these countries has been completely effected, it is the duty of the authoritative government to make immediate and stringent arrangements for improving and regulating the forest culture. A prompt interference of the authorities would—besides greatly enhancing the value of the forests—raise the revenues of the country, and thus prove not only of the greatest interest to the Bosnian population, but of considerable import in respect to the financial situation of the country itself.

Draining of Bog Land by Planting.

(From the "*Journal of Forestry*" and *Estates' Management*.)

SIR,—A successful and profitable method of effectually draining bog land having come under our notice, we think that, with your permission, we ought to make it as widely known as possible, through the medium of your *Journal*. Upwards of forty years ago Mr. Adam Murray, then land agent to the Earl of Jersey, planted a bog near the Button Ferry Station, South Wales. This bog was quite useless and even dangerous, as people often lost their cattle and pigs in its wet quagmires. Mr. Murray planted it with black Italian poplar, which we supplied, and the trees made such extraordinary growth, that at the end of fifteen years, when they were cut down, the produce realized something like £13 per annum per acre, for the whole period of fifteen years during which the crop had occupied the ground; it luckily happening that the poles were just wanted in the neighbouring copper works.

However, this was not all the benefit or profit derived from planting the bog with these rapid-growing trees. Their strong roots running through the underlying clay thoroughly drained the bog, letting off the water in a way that no other process of draining can accomplish. Beneath all bogs, which are formed of decomposing vegetation, there lies a bed of clay, and below that comes a bed of gravel. The strong roots of the poplar will run down through the soft bog to a depth of many feet, and pierce through the bed of clay some feet thick into the gravel.

In these days of great demand for packing-cases, grocer's-boxes, &c., the timber of this poplar is very valuable, and the tree has the additional property of arriving at a fit state to be cut down in a man's lifetime. When the timber was removed, a charge of gunpowder was inserted in each stool, which effectually burst them up and rendered their removal easy. After the ground was cleared, a beautiful rich, firm pasture remained.

WM. MAULE AND SONS.

The Nurseries, Bristol.

THE "Ora" bamboo of Chittagong, *Bambusa Brandisii*, Munro, is flowering this year. Large patches of leafless stems may be seen on all the hill sides of the forests of the hill tracts. Is the same bamboo also flowering in Burma?

WE suppose most of our readers have seen the circular of the Italian Government offering a prize for an essay on "Citrus." We hope some competitors may be found in India, but as an Italian translation must necessarily accompany the English essay, it does not seem likely that many will offer.

IN a "Note on the species of *Prosopis*," at p. 154 of Vol. IV., "*P. juliflora*, DC.," was inadvertently given as belonging to the section *Strombocarpa*. It should have been the section *Algarobia*. It appears to be growing well in the Madras Presidency, and is possibly not distinct from *P. glandulosa*.

THERE seems every likelihood that an attempt will be made to train African elephants as bearers of burdens, and indeed it is stated that an Association has been formed for the opening up of African trade by this means. This seems to us a much more sensible and practicable plan than the construction of a railway, which has been so prematurely proposed in some quarters. With the aid at first of Indian trainers we see no reason why the African elephant should not be made as useful as his Indian brother.—*Nature*, April 3rd, 1879.

Reviving Young Trees.—When young trees have been out of the ground a few days, either in transit from the nursery or otherwise, and not properly cared for, the bark becomes shrunken, and, although the roots may be in tolerably good condition, there is great danger that the tree may die after it is planted, especially is this the case with peach trees. This may be prevented by burying the whole tree a few days. To do this, dig a trench as wide as the tree is high, and about 8 inches deep at one end and 16 inches deep at the other, and long enough to hold all the trees to be buried, when laid in the trench five or six trees on the top of one another. Lay the trees in the trench with the roots at the deep end of it, laying them straight and packing them close together, but do not pile them up above the level of the ground. Now cover the trees, tops, and roots 12 inches to 15 inches with earth. If the ground be very dry, a few buckets of water should be slowly sprinkled over the earth after the trees are buried. In four or five days they must be taken out and transplanted immediately, being careful to cut back the tops. I have known trees thus buried when taken from the pit to look as fresh as when dug at the nursery, and with proper care never knew one of them to die.—COUNTRY GENTLEMAN.—*The Garden*, May 17th, 1879.

WE regret to have, since our last issue, to announce the death of another Forest Officer. Mr. H. R. Ring, Assistant Conservator in Bengal, died at Julpigori on Sunday, the 15th, after only a few days' illness. Mr. Ring had passed most of his service in Coorg, and had only recently been transferred to Bengal.

WE have received from Mr. T. Routledge copies of the *Journal of the Society of Arts*, for April 18th and 25th, 1879, containing a continuation of the correspondence between him and Dr. King on the subject of the experiments made in the Calcutta Botanical Garden in the cultivation of the bamboo. There is little of interest in the discussion, except that Mr. Routledge reports having received his first consignment of young stem from Burma—stems which had been crushed by the rolls sent out by him; and that he had to pay on them 40s. per ton carriage from Liverpool, rate which precludes their being carried home otherwise than as ‘paper stock.’

THE Financial Resolution abolishing the Department of Revenue, Agriculture, and Commerce will only affect the Forest Department by transferring the work of the “Forest Branch” to the new “Home, Revenue and Agricultural” Department.

WE are glad to see in the Resolution of the Government of India that “The Forest Revenue and the scientific management of the forests, has, in most provinces, been developed greatly by the Local Governments, under the advice, and with the assistance of the Inspector-General of Forests.”

THE *Colonies and India* has an interesting note on the subject of Vanilla, which appears to be mainly supplied by Mauritius, Brazil and Mexico, but could probably be grown in many of our Colonies. The parasitical plant which yields this aromatic bean will climb up any tree that gives sufficient shade; it attains a height of about a foot, and thrives for thirty or forty years, producing some fifty pods each year after the second. The beans take eight or nine months to mature, and are gathered between October and December; they are oiled occasionally to prevent excessive shrinking, and dried in the sun. When warm, they are wrapped in woollen cloths to absorb the evaporation, and during the process attain their black silvery hue. Vanilla is the most costly, in proportion to weight, of all vegetable productions, and only a few hundredweights reach England annually.—*Nature*, 20th March 1879.

WE gather from the *Colonies and India* that some interesting papers have appeared in the Ceylon press, relative to the suitability of that island for the growth of Australian trees. The blue gum-tree does not seem to flourish under an elevation of 3,000 feet. The *Casuarina* grows freely even by the sea shore. The *Grevillea robusta*, one of the most beautiful and most useful of Australian trees, had thriven well in Colombo itself, though it will not stand the full force of the sea breezes.—*Nature*, 3rd April 1879.

SCARCITY OF THE HEMLOCK SPRUCE.—Official returns show that in New Brunswick the Hemlock Spruce (*Abies canadensis*) is becoming as scarce as in adjacent parts of the United States. "It is found only in certain parts of the island, and is rapidly diminishing owing mainly to the ravages of fire, to which it is peculiarly subject, and to the fact that a large number of trees are cut down for the sale of the bark only, the timber being left to rot in the ground." The reports from the other parts of the dominion bespeak the same reckless waste of all kinds of timber. In British Columbia, which has an area about twice that of the United Kingdom, two-thirds, or in round numbers 110,000,000 English acres, are still covered with timber. A variety of the Hemlock Spruce is one of the commonest trees there.—*The Timber Trades Journal*, 26th April 1879.

LETTERS continue to be received from the museums and other establishments to which collections of Indian woods were sent last year, expressing pleasure with the collections sent. Chiefly the authorities at Kew have written in praise of the magnificent collections sent, and say that their museum of economic botany is now delightfully complete, with the assistance of the exhibition duplicates, and other specimens lately forwarded. We regret, however, to learn that one of the most interesting points about the collections, viz., the series of the same species from different localities in India, has been lost by the distribution to other English and foreign museums of most of the series, one or two only being kept. Had they been European collections, one specimen from France, another from Germany, and so on,

they would have been carefully prized ; but we suppose that even the Kew authorities have failed sufficiently to realize the size of India and the difference, geographical and climatic, between its many regions.

WITH reference to our review in Part 4, of Volume IV on Captain Van Someren's List of the trees of Mysore and Coorg, we are informed that the Sissoo is really not uncommon in Mysore. It is said to grow in Bangalore, Mysore, Seringapatam, and Tumkur, occasionally in villages and frequently in the compounds of Bungalows. It is, however, not an indigenous, but an imported tree, and this should have been stated in the List.

IMITATION EBONY.—The *Revue Industrielle* states that oak may be dyed black, and made to resemble ebony by the following means :—Immerse the wood for 48 hours in a hot saturated solution of alum, and then brush it over with a logwood decoction, as follows :—Boil one part of best logwood with ten parts of water, filter through linen, and evaporate at a gentle heat until the volume is reduced one-half. To every quart of this add from 10 to 15 drops of a saturated neutral solution of indigo. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained. Oak stained in this manner is said to be as close as well as a splendid imitation of ebony.—*Timber Trades' Journal*, 10th May 1879.

THE following extract from a despatch from the Secretary of State for India, to the Government of India, was ordered by the Governor to be published in the *Bombay Gazette* :—

“The most noteworthy remarks contained in the review are those made in connection with the forests of Coorg, upon the importance of which, from a local point of view, and in relation to the surrounding countries, due stress is laid. Of the condition of the forests in the neighbouring districts, and along the line of the Ghâts, a very unfavourable picture is drawn.

I trust, however, that the interest displayed by Sir R. Temple in the question of forest conservancy may have the effect of remedying the mischief which has been done in the Bombay Presidency, and that a speedy settlement of the disputed rights of the State and of individuals in the forests of North Kánara, now pending before the High Court at Bombay, will remove all obstacles to a determination on the part of the Madras Government of similar disputed rights in South Kánara and elsewhere, and to the acquisition of a sufficient extent of forest to secure the country from the evils which a continuation of the present practice of denudation would inevitably involve. In connection with this subject, I have recently addressed Your Excellency and the Madras Government."

Y. THE TIMBER MARKET,

London wholesale cargo prices of Fancy Timbers.

(*Timber Trades' Journal*, April 26th, 1879.)

MAHOGANY—				
St. Domingo	... per superficial foot	0 0 6	@ 0 1 0	
Cuba ...	... none „ nominal	0 0 6	„ 0 0 8½	
Honduras	... „	0 0 4	„ 0 0 6	
Mexican	... „	0 0 4	„ 0 0 5½	
CEDAR—				
Havana, &c.	... „	0 0 4½	„ 0 0 5½	
WALNUT—				
Italian ...	... „	0 0 8	„ 0 0 5	
SATINWOOD—				
St. Domingo	... „	0 0 6	„ 0 1 0	
ROSEWOOD—				
Rio ...	... nominal	17 0 0	„ 20 0 0	
Bahia ...	... „	16 0 0	„ 19 10 0	
LIGNUM VITÆ—				
St. Domingo	... „	3 10 0	„ 10 0 0	
Bahama, Jamaica, &c.	... „	3 0 0	„ 6 0 0	
GREENHEART—				
Demerara	... per load	5 0 0	„ 5 10 0	
TEAKWOOD—				
East India	... „	9 0 0	„ 10 0 0	

MAHOGANY AND HARDWOOD MARKETS.

At the Commercial Sale Rooms, on the 29th April, Messrs. Geo. SHADBOLT and SON, brokers :—

Tabasco mahogany, 117 logs, ex “Grijalva,” all sold at 4d. to 6½d.

Cuba mahogany, 225 logs, ex “Petita-y-Vicenta,” chiefly sold at 5½d. to 1s. 4½d.

Tabasco cedar, 2 logs at 5½d.

Dominica satinwood, 5 logs at 5½d.

Italian walnutwood, 2,661 planks at 4½d.

124 LONDON WHOLESALE CARGO PRICES OF FANCY TIMBERS.

. At the "Baltic" Sale Room, on the 30th April, Messrs. CHURCHILL and SIM, brokers :—

Honduras mahogany, 269 logs, ex "Flid" from Belize, sold at 3½d. to 10½d. ; average, 4⅝d.

Honduras cedar, 30 logs, ex "Flid," 4½d. to 5½d. ; average, 4½d. fully.

Cuba mahogany, 31 logs, ex "Truthful," 6½d. to 5s. 6d. ; average, 10½d. fully.

St. Domingo mahogany, 15 logs, ex "Elizabeth Stevens," 5½d. to 8½d. ; average, 6⅝d.

St. Domingo satinwood, 32 logs, ex "Libra," 6½d. to 10½d. average, 7⅞d. fully.

50 logs ditto, ex "Oceana," 6½d. to 2s. 9d ; average, 9½d.

American walnutwood, 19 logs, ex "Everest," at 4s. 9d. to 5s. per cubic foot.

At the Commercial Sale Rooms, on the 6th inst., Messrs. THOMAS EDWARDS and SONS, brokers :—

Tabasco mahogany, 191 logs (117,964½ ft.) ex "Solveig" from Tonala, sold at 4d. to 7½d. ; average, 4⅝d. fully.

Mexican mahogany, 80 logs (28,720½ ft.) ex "Magda" from Minatitlan, 3½d. to 5d. ; average, 3½d.

Honduras mahogany, 63 logs (22,507 ft.) ex "Ornen" from Belize, 3½d. to 4½d. ; average, 3⅝d.

LIVERPOOL MAHOGANY SALES.

On the same day the same brokers offered an entire cargo of Tabasco mahogany, together with remnants of other cargoes, parcels of walnut and pencil cedar, and sold nearly all with-drawing only about 120 logs Tabasco mahogany.

There was a fair attendance, and the prices were without material change, as will be seen from this result.

Tabasco mahogany @ Santa Ana	292 logs	4d. to 8d.	average 5½d.
" " " "	27 "	4½d. to 8d.	" 5½d.
" " " Tonala	28 "	4½d. to 4½d.	" 4½d.
" " " "	12 "	4½d. to 5½d.	" 4½d.
Mexican " " Minatitlan	5 "	4d. to 5d.	" 4½d.
Circassian walnut " Constantinople	68 "	4½d. to 7½d.	" 5½d.
Pencil cedar " Fernandina	78 "	2s. per cubic foot.	
" " " "	208 "	1s. 10d.	"

VJ. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.—

No. 353F.—18th April 1879.—*Mr. C. W. Palmer*, Sub-Assistant Conservator, and Officiating Assistant Conservator of Forests of the 3rd Grade in British Burma, is granted six months' leave on private affairs, under Sections 5 and 6, Supplement F. of the Civil Leave Code, with effect from such date as he may avail himself of it.

No. 355F.—*Mr. H. G. Young*, Officiating Sub-Assistant Conservator of Forests, attached to the Forest Survey Branch, is transferred to Assam.

No. 449F.—27th May 1879.—The Governor-General in Council is pleased to make the following promotions in the Forest Department:—

Permanent promotions.

Mr. G. Mann, Assam, to be a Deputy Conservator of the 2nd Grade, from the 21st February 1879.

Mr. W. Rigby, Punjab, to be a Deputy Conservator of the 3rd Grade, from the 21st February 1879.

Mr. L. A. W. Rind, North-Western Provinces, to be an Assistant Conservator of the 1st Grade, from the 21st February 1879.

Mr. H. R. Ring, Bengal, to be an Assistant Conservator of the 3rd Grade, from the 11th February 1879.

Mr. E. A. Down, Punjab, to be an Assistant Conservator of the 3rd Grade, from the 21st February 1879.

Mr. A. N. Reuther, Punjab, to be a Sub-Assistant Conservator, from the 11th February 1879.

Mr. H. B. Anthony, Central Provinces, to be a Sub-Assistant Conservator from the 21st February 1879.

Officiating promotions.

Mr. C. F. Elliott, Punjab, to officiate as a Deputy Conservator of the 3rd Grade, from the 3rd April 1879.

Mr. E. E. Fernandez, Central Provinces, to officiate as an Assistant Conservator of the 1st Grade, from the 22nd January 1879.

Mr. A. Smythies, B.A., North-Western Provinces, to officiate as an Assistant Conservator of the 1st Grade, from the 3rd April 1879.

Mr. E. F. Litchfield, Survey Branch, to officiate as an Assistant Conservator of the 3rd Grade, from the 22nd January 1879.

Mr. W. M. Green, Bengal, to officiate as an Assistant Conservator of the 3rd Grade, from the 11th February 1879.

Mr. A. N. Reuther, Punjab, to officiate as an Assistant Conservator of the 3rd Grade, from the 21st February 1879.

Mr. R. J. P. Pinder, Forest Ranger of the 1st Grade, to officiate as a Sub-Assistant Conservator, from the 3rd April 1879.

No. 462F.—29th May 1879.—*Mr. A. T. Drysdale*, Deputy Conservator of Forests of the 2nd Grade, in the Hyderabad Assigned Districts, is granted furlough to Europe for six months, under Section 21 of the Civil Leave Code, with effect from the 15th June 1879, or any subsequent date on which he may avail himself of it.

No. 493F.—4th June 1879.—*Major W. J. Seaton*, Conservator of Forests of the Tenasserim Circle in British Burma, is appointed, in addition to his own duties, to act as Conservator of Forests of the Pegu Circle, during the absence of *Mr. B. Ribbentrop*, on three months' privilege leave, with effect from the 12th May 1879.

No. 497F.—5th June 1879.—*Mr. R. J. P. Pinder*, Officiating Sub-Assistant Conservator of Forests, is transferred from the Punjab to Oudh.

No. 500F.—6th June 1879.—*Captain G. J. VanSomeren*, Conservator of Forests of the 4th Class and Assistant to the Inspector-General of Forests, is granted subsidiary leave of absence under Chapter IV, Section 34, of the Civil Leave Code, with effect from the forenoon of the 3rd June 1879, preparatory to applying for furlough.

No. 533F.—18th June 1879.—*Mr. C. W. Palmer*, Sub-Assistant Conservator, and Officiating Assistant Conservator of Forests of the 3rd Grade in British Burma, availed himself, on the forenoon of the 12th May 1879, of the six months' leave on private affairs granted to him in Notification No. 353F., dated the 18th April last.

2.—CALCUTTA GAZETTE.—

The 22nd April 1879.—The following Rules passed by the Lieutenant-Governor of Bengal, under Sections 31 and 41 of the Indian Forest Act, VII of 1878, having received the sanction of the Governor-General in Council, are hereby published for general information. They will take effect in the Protected Forest Tracts of the Sunderbuns described in the Schedule annexed to the Notifications of the 7th December 1878, and 24th February 1879, (published in the *Calcutta Gazette* of the 11th December 1878 and 26th February 1879), and will come into force from the 1st July 1879.

Rule I.—On and after the 1st July 1879, no trees, timber, or any other forest produce shall be cut, sawn, gathered, or removed from within the boundaries of the Sunderbuns Protected Forests without prepayment in full of the charges due thereon at the rates following:—

- (1.) For every maund of sundri timber one anna.
- (2.) For every maund of any other forest produce, one-fourth of one anna.

Rule II.—Any person desiring to enter the Sunderbuns Protected Forests for the purpose of cutting, sawing, converting, gathering, or removing trees, timber or any other forest produce, shall take out a permit or license for the produce which he proposes to remove. The said permit will be granted only, on prepayment of the prescribed charges, by the officer in charge of the Sunderbuns Forest Division, or by any of his subordinates duly authorised to receive payment and to issue permits.

Rule III.—The holder of a permit or license for the cutting, sawing, conversion, gathering, or removal of any forest produce within the boundaries of the Sunderbuns Protected Forests, shall produce the said permit or license when called upon to do so by any Forest or Police Officer; and shall further be bound, on leaving the Sunderbuns Protected Forests, to return the said permit or license to one of the forest officers in charge of the revenue stations, a list of which will be notified from time to time in the *Calcutta Gazette*.

Rule IV.—Any forest produce in transit within or passing out of the Sunderbuns Protected Forests, and any such produce found in any water-channel skirting or leading from the said forests, when there is reason to believe that any thing is payable to the Government in respect of such produce, may be stopped and examined by any Forest or Police Officer.

Rule V.—The clearing and breaking up of land for cultivation and other purposes within the Sunderbuns Protected Forests is prohibited, except in accordance with such rules as the Local Government may from time to time issue, with the previous sanction of the Governor-General in Council.

Rule VI.—Any person who desires to transport any forest produce through the Sunderbuns Protected Forests, or through any part of them, or along any of the water-channels intersecting or skirting them, shall be bound to take out a pass at any one of the revenue stations, a list of which will be published from time to time in the *Calcutta Gazette*, and he shall further be bound to produce such pass when called upon to do so by any Forest or Police Officer, and to return such pass at any one of the said revenue stations on passing out of the boundary of the Protected Forests. The fee, if any, payable for such passes will from time to time be fixed by the Conservator of Forests and notified in the *Calcutta Gazette*.

The following is a list of the revenue stations referred to in rules 3 and 6 of the above rules :—

- | | |
|-----------------|----------------------------|
| 1. Lower Bhola. | 9. Isreepore (Eshamuttee.) |
| 2. Upper Bhola. | 10. Buseuntpore. |
| 3. Pusaur. | 11. Roymangal. |
| 4. Khulna. | 12. Rampura. |
| 5. Bhudder. | 13. Mutlab. |
| 6. Seepsah. | 14. Bogee. |
| 7. Koyrah. | 15. Saterbog. |
| 8. Cobaduk. | 16. Moore Gunga. |

The 22nd April 1879.—In continuation of the Notification, dated 18th May 1878, published in the *Calcutta Gazette* of the 9th May 1878, proposing to constitute three blocks of reserved forests in the Chittagong Hill Tracts under the provisions of Act VII of 1878, and appointing the Deputy Commissioner of the Chittagong Hill Tracts to be the Forest Settlement Officer under the provisions of the same Act, it is hereby notified, under Section 4 of that Act, that it is proposed to constitute the following tracts of country in the Chittagong Hill Tracts, lying within the boundaries described below, reserved forests under the provisions of the said Act.

VI.—BOUNDARIES OF THE PROPOSED RINKHEONG RESERVE.

The area drained by the Rinkheong river and its feeders, bounded as follows :—

North.—A line starting from Saichal Hill, No. 3, along the ridge separating the Soobalong Valley from that of the Laylounkh-eong, a tributary of the Rinkheong, to the Belasuri ridge; thence, across the Rinkheong Valley in a south-west direction to Alaisurri Hill, on the water-shed between the Rinkheong and Kaptai Valleys.

East.—The long ridge called Ringtong and Weyboongtong, from Saichal Hill, No. 3, to the frontier, at the head of the Peekheong.

South.—The frontier line of the Chittagong Hill Tracts separating the valleys of the Rinkheong and Peekheong.

West.—The water-shed between the Rinkheong Valley on the one side, and the Sungoo and Kaptai Valleys on the other, and running south from Alaisurri Hill through Pharohtong, Pyramid Hill, and Polytai, to where it meets the frontier line a little south of the point marked Ramakritong.

V.—BOUNDARIES OF THE PROPOSED SUNGOO RESERVE.

The area drained by the Sungoo river and its tributaries south of a line running east and west across that river at the mouth of the Modagrikheong.

2. The Lieutenant-Governor appoints the Deputy-Commissioner of the Chittagong Hill Tracts to be the Forest Settlement Officer, under the provisions of Chapter II of the said Act VII of 1878, to enquire into and determine the existence, nature, and extent of any rights alleged to exist in favor of any person in or over any land comprised within the boundaries specified above, or in, or over, any forest produce to be found therein, (not being rights for surrender of which compensation has already been awarded in the course of proceedings already taken under Act VII of 1865,) and to deal with the same as by law provided.

The 29th April 1879.—*Mr. W. Jacob*, Deputy Conservator of Forests, 2nd Grade, Palamow Division, is allowed furlough for one year, under Sections 20 and 21 of the Civil Leave Code, together with subsidiary leave for 30 days, under Section 34 of the Code, with effect from such date as he may avail himself of it.

Mr. R. N. Anstruther, Assistant Conservator of Forests, 3rd Grade, in the Teesta Division, is appointed, until further orders, to have charge of the Palamow Division.

The 9th May 1879.—The orders of the 14th September 1878, granting *Mr. W. Johnston*, Assistant Conservator of Forests, two months' leave, under Chapter I, Section 2, paragraph 24 of the Forest Department Code, are cancelled.

The 26th May 1879.—It is hereby notified, under Section 4 of Act VII of 1878 (the Indian Forest Act), that it is proposed to constitute the following tract in the Hazareebagh District, lying within the boundaries described below, a reserved forest, under the provisions of the said Act:—

THE KODERMA RESERVE.

North.—The boundary between the Gya and Hazareebagh Districts, from a stream running in a south-west direction to the east of Bisneeteeekur to the point where the boundary be-

tween Pergunnahs Koderma and Kurrukdiha meets the Gya District boundary.

East.—The boundary between Pergunnahs Koderma and Kurrukdiha, from the above point to a point about half a mile south of the Phootlihi River.

South.—A demarcated line in a direction slightly south of east to the source of the river, which rises at Phulwuriya, and then that river.

West.—The same river, then a demarcated line, first north, then north-east, then north, and then north-east, again to the river near Bisneeteeekur, and then that river.

The Lieutenant-Governor appoints the Deputy Commissioner of Hazareebagh to be the Forest Settlement Officer, under the provisions of Chapter II of the said Act VII of 1878, to enquire into, and determine the existence, nature, and extent of, any rights alleged to exist in favor of any person in or over any land comprised within the boundaries specified above, or in, or over, any forest produce to be found therein, and to deal with the same as by law provided.

The 17th June 1879.—*Mr. W. M. Green*, Officiating Assistant Conservator of Forests, Chittagong, is allowed leave for two months, under Section 13, Supplement F. to the Civil Leave Code.

3.—GAZETTE OF THE NORTH-WESTERN PROVINCES AND OUDH.—

No. 313.—*8th April 1879.*—*Mr. R. S. Dodsworth*, Assistant Conservator of Forests, furlough to Europe for 16 months from 1st May 1879, together with the usual subsidiary leave.

No. 356.—*22nd April 1879.*—*Mr. O. Greig*, Assistant Conservator of Forests, returned on the forenoon of the 5th April 1879, from the leave granted to him in this Department Notification No. 808A, dated the 24th December 1878, and resumed charge of the Bhagirathi Division at the same time.

No. 376.—*24th April 1879.*—*Mr. R. S. Dodsworth*, Officiating Deputy Conservator of Forests, made over, and *Mr. S. E. Wilmot*, Assistant Conservator, received charge of the Newulkhur and Khairigarh Sub-divisions of the Kheri Division on the afternoon of the 2nd April 1879.

No. 377.—*24th April 1879.*—*Mr. S. E. Wilmot*, Assistant Conservator, made over, and *Mr. B. A. Rebsch*, Officiating Sub-Assistant Conservator, received charge of the Bahraich and Gonda Forest Divisions, as a temporary measure, on the afternoon of the 19th March 1879.

- No. 413.—*2nd May 1879.*—*Mr. O. Greig*, Assistant Conservator of Forests, Bhagirathi Division, six months' leave on private affairs from 1st May 1879, or subsequent date, with subsidiary leave not exceeding seven days under Clauses (a) and (b), Section 24, of the Civil Leave Code respectively.
- No. 473.—*13th May 1879.*—*Mr. R. S. Dodsworth*, Assistant Conservator of Forests, reported his departure from Bombay per steamer *Assyria* on the forenoon of the 1st May 1879, on the leave granted to him in this Department Notification No. 313, dated the 8th April 1879.
- No. 502.—*21st May 1879.*—*Mr. O. Greig*, Assistant Conservator of Forests, Bhagirathi Division, availed himself of the leave granted to him by Notification No. 413, dated the 2nd May 1879, on the afternoon of the 5th idem, making over charge of his Division on the same afternoon to *Mr. A. R. Grant*, Officiating Deputy Conservator, Garhwal Division.
- No. 514.—*26th May 1879.*—*Mr. B. A. Rebsch*, Sub-Assistant Conservator of Forests, Bahraich Division, made over, and *Mr. W. G. Allan*, Deputy Conservator, Gorakpur Division, received charge of the Gonda Division, on the afternoon of the 22nd April 1879.
- No. 531.—*31st May 1879.*—*Mr. S. E. Wilmot*, Assistant Conservator of Forests, returned from the three months' privilege leave granted to him in Notification No. 114A., dated the 30th May 1878, on the forenoon of the 8th October 1878.
- No. 578.—*14th June 1879.*—Under Section 4, Act VII of 1878, the Lieutenant-Governor and Chief Commissioner hereby declares that it is proposed to constitute the Babuapur waste land allotment, which has been relinquished into the hands of Government by the grantee, and has thereby become the sole property of Government, and of which the boundaries are given below, a reserved forest. Under Section 4 (c) of the said Act, the Deputy Commissioner, Kheri, is appointed Forest Settlement Officer; and, under Section 16, the Commissioner of the Sitapur Division is empowered to hear any appeals that

may be preferred from the orders of the Forest Settlement Officer:—

District.	Pargana.	Name of tract which it is proposed to constitute reserved forest.	Description of Boundaries.
Kheri...	Bhūr...	Babuapur	<i>North-west.</i> —Kaptowra reserved forest. <i>North-east.</i> —Kaptowra, Pararia, Bahadurnagar. <i>South-east.</i> —Palhaanapur reserved forest. <i>South-west.</i> —Eeth's grant (formerly jungle nazul No 3).

No. 596.—18th June 1879.—*Mr. L. A. W. Rind*, Assistant Conservator of Forests, returned on the forenoon of the 15th May 1879, from the leave granted to him in Notification No. 121, dated the 19th February 1879. The unexpired portion of his leave, viz., 17 days, is hereby cancelled.

4.—PUNJAB GAZETTE.—

No. 152F.—3rd April 1879.—*Leave.*—*Mr. E. A. Down*, Officiating Assistant Conservator of Forests, has obtained six months' leave to Europe on urgent private affairs, together with fourteen days' subsidiary leave of absence under Section 24 (a) of the Civil Leave Code, with effect from the 1st April 1879, or such subsequent date as he may avail himself of the same.

No. 156F.—3rd April 1879.—*Notification.*—With reference to *Punjab Government Gazette* Notification No. 405F., dated 7th November 1878, *Mr. G. G. Minniken*, Assistant Conservator of Forests, was relieved of the charge of the Plantation Division by *Mr. F. d'A. Vincent*, Assistant Conservator of Forests, on the afternoon of the 14th March 1879, and assumed charge of the Sutlej Division from *Mr. C. E. Fendall*, Officiating Assistant Conservator of Forests, on the forenoon of the 19th idem.

No. 178F.—*Appointment.*—*Mr. J. S. Mackay*, Assistant Conservator of Forests, is appointed to the charge of the current duties of the Bias Division, during the absence on leave of *Lieutenant-Colonel Stenhouse*.

No. 181F.—*Leave.*—*Mr. E. A. Down*, Officiating Assistant Conservator of Forests, reported his departure from Karachi

- on the 11th April 1879, on the leave granted to him in *Punjab Government Gazette* Notification No. 152F, dated 3rd idem.
- No. 177F.—19th April 1879.—*Leave*.—Lieutenant-Colonel W. Stenhouse, Deputy Conservator of Forests, Bias Division, has obtained privilege leave of absence for threemonths with effect from the afternoon of the 1st April 1879.
- No. 191F.—25th April 1879.—*Notification*.—Mr. A. Pengelly, Deputy Conservator of Forests, reported his arrival at Lahore on the 6th March 1879, on return from leave.
- No. 192F.—Mr. A. Pengelly, Deputy Conservator of Forests, is appointed to the charge of the Fuel Reserve, Northern Division, with effect from the afternoon of the 3rd April 1879, *vice* Mr. E. McA. Moir, proceeding on leave.
- No. 208.—2nd May 1879.—*Notification*.—The Hon'ble the Lieutenant-Governor is pleased to prescribe the following rules under Clause I, Section 25 of Act VII. of 1878, the Indian Forest Act, regarding hunting and shooting in Reserved Forests:—
- I.—Hunting or shooting with elephants and with large parties of coolies or beaters is prohibited.
 - II.—Hunting or shooting between the 15th March and 15th September (both days inclusive) in each year is prohibited.
 - III.—The Conservator of Forests may declare and publicly notify any Reserved Forest or portion of such forest to be altogether closed for such periods as may be necessary when it is desirable in his judgment to close such forest or portion of a forest.
 - IV.—The poisoning of water and the setting of snares and traps is prohibited.
 - V.—Subject to the above restrictions, hunting or shooting is permitted; but nothing in this rule shall be taken to exempt any person from liability in respect of any offence by fire, injury to the forest or its produce, or other offence punishable by Section 25, Act VII of 1878.
 - VI.—When not restricted by any existing right or lease of such right, fishing, otherwise than by nets, in any stream or other water, is permitted in any forest not being a forest closed under the provisions of Rule III.
- No. 222F.—9th May 1879.—*Notification*.—Under Section 45 of Act VII of 1878, the Hon'ble the Lieutenant-Governor is pleased to direct that the following shall be the areas within which all unmarked wood and timber shall be deemed to be the property of Government, until, and unless, any person establishes his right and title thereto.
- The Jhelum and its tributaries within British territory;
- | | | |
|------------|-------|--------|
| The Chenáb | ditto | ditto; |
| The Rávi | ditto | ditto; |
| The Beás | ditto | ditto; |
| The Sutlej | ditto | ditto; |

including an area within a direct distance of five miles from either bank of the main stream of the said rivers, taking that stream at its cold season level.

No. 163F.—9th April 1879.—*Notification*.—Mr. A. N. Reuther, Sub-Assistant Conservator of Forests, Fuel Reserve, Northern Division, having reported his return to duty on the forenoon of the 26th February 1879, the unexpired portion (two days) of the privilege leave of absence granted to him in *Punjab Government Gazette* Notifications Nos. 51F. and 100F., dated respectively 29th January and 4th March 1879, is hereby cancelled.

No. 247.—3rd June 1879.—*Notification*.—The furlough to Europe granted to Mr. W. Rigny, Assistant Conservator of Forests, 1st Grade, in *Punjab Government Gazette* Notification No. 19F., dated 16th January 1878, has been converted by Her Majesty's Secretary of State for India into leave on medical certificate for fifteen months and a half.

No. 271F.—20th June 1879.—Mr. A. Pengelly, Deputy Conservator of Forests, Fuel Reserve, Northern Division, has obtained six months' special leave on urgent private affairs, under Section 31, of the Civil Leave Code (4th Edition), together with five days' subsidiary leave of absence under Section 34 of the same Code, with effect, from the afternoon of the 31st May 1879.

No. 272 F.—Mr. A. Pengelly, Deputy Conservator of Forests reported his departure from Bombay on the 6th June 1879, on the special leave granted to him in *Punjab Government Gazette* Notification, No. 271F., dated 20th idem.

No. 276F.—Mr. E. Forrest, Assistant Conservator of Forests, Jhelum Division, is transferred to the Fuel Reserve, Northern Division, and appointed to the charge of that Division, with effect from the afternoon of the 31st May 1879, vice Mr. A. Pengelly, proceeding on leave.

No. 277F.—Mr. A. N. Reuther, Sub-Assistant Conservator of Forests, from the Fuel Reserve, Northern Division, to the Jhelum Division.

5.—CENTRAL PROVINCES GAZETTE.—

No. 1612.—5th April 1879.—*Mr. H. B. Anthony*, Sub-Assistant Conservator of Forests, transferred from the Province of Mysore to these Provinces, is posted to the Nimar district. *Mr. Anthony* reported his arrival at Khandwa, and assumed charge of his duties on the 8th ultimo, before noon.

No. 1734.—24th April 1879.—Under Section 37 of Act X of 1872, the Chief Commissioner is pleased to appoint *Mr. R. H. E. Thompson*, Deputy Conservator of Forests, Southern Division, to be a Magistrate of the 2nd class in that Division.

No. 1890.—24th April 1879.—The one year's leave on medical certificate granted to *Mr. J. E. L. Huddleston*, Sub-Assistant Conservator of Forests, by Notification No. 128, dated 10th January last, will have effect from the 19th October 1878.

No. 2561.—17th June 1879.—*Mr. H. B. Anthony*, Sub-Assistant Conservator of Forests, is temporarily transferred from the Nimar to the Chanda Forest Division.

7.—ASSAM GAZETTE.—

No. 15.—29th May 1879.—*Mr. W. E. D'Arcy*, Assistant Conservator of Forests, in charge of the Sibsagar Division, has also been placed in charge of the Golaghat Forest Division, and his head-quarters are moved from Sibsagar to Golaghat as a temporary arrangement.

No. 17.—18th June 1879.—*Mr. W. E. D'Arcy*, Assistant Conservator of Forests, in charge of the Sibsagar Division, has also been placed in charge of the Golaghat Forest Division, with head-quarters remaining at Sibsagar. Notification No. 15, dated 29th May 1879, published in the *Assam Gazette* of 31st May 1879, is hereby cancelled.

No. 18.—18th June 1879.—In exercise of the powers conferred by section 4 of the Indian Forest Act, 1878, the Chief Commissioner hereby declares that it is proposed to constitute the land described in the Schedule hereto annexed a reserved forest, and appoints *Mr. R. Lea*, Extra Assistant-Commissioner, to be the Forest Settlement Officer to inquire into and determine the existence, nature, and extent of any rights which may exist in favour of any person in or over any land comprised within the limits as described in the Schedule

hereto annexed, or in or over any forest produce, and to deal with the same as provided in Chapter II. of the above Act. The Chief Commissioner is also pleased, under the provisions of section 16 of the above Act, to appoint the Deputy Commissioner of Nowgong to be the officer to hear appeals from the orders of the Forest Settlement Officer.

District.	Pergunnah or other Sub-division.	Name of Forest.	Description of Boundaries.
Nowgong ...	Kaliabar mehal	Diju Forest ...	<p><i>West</i>.—The Salona road from the western boundary of the Nijrkhat grant No. 3 to the southern boundary of the pottah land held by Messrs. Mackinnon, Mackenzie & Co.</p> <p><i>North</i>.—From the Salona road eastward along the southern boundary of the said pottah land and Kelly Den estate to the Mikir pathway on the east.</p> <p><i>East</i>.—The Mikir pathway from the Kelly Den estate on the north to Ram Sing's grant under New Lease Rule No. 47 to the south, and thence along the western boundary of the latter grant and the northern and western boundaries of the Lengteng grant to the Diju River.</p> <p><i>South</i>.—The Diju River from the south-west corner of the Lengteng grant to the south-east corner of the Salona grant No. 54, and thence along the eastern and northern boundaries of that grant, and the northern and western boundaries of the Nijrkhat grant No. 3 to the Salona road at the point where it enters grant No. 3.</p>

8.—MYSORE GAZETTE—

9th May 1879.—Notice is hereby given for public information that under the provisions of para. 3, of the Coorg Forest Rules, published under Government of India Notification No. 129, dated 11th August 1871, the undermentioned forests, situated in Coorg, are declared to be Government Forest Reserves:—

District.	Taluk & Hobli.	Name of Forest.	Description of Boundaries.
Coorg...	Yelsavirshime Taluk, Nidatada Hobli.	Menasada betta or Sandakoti.	<p><i>North</i>.—Mysore boundary.</p> <p><i>South</i>.—Gangavara and Menasada villages.</p> <p><i>East</i>.—Kiserahalli and Gangavara.</p> <p><i>West</i>.—Kyatanahalli and Bettadahalli.</p>
Do. ...	Do. ...	Alur ...	<p><i>North</i>.—Kanavebasvanahalli and Hosahalli.</p> <p><i>South</i>.—Alur village.</p> <p><i>East</i>.—Mysore boundary.</p> <p><i>West</i>.—Alur and Malembi villages.</p>

No. 11.—*20th June 1879.*—*Mr. W. King*, Assistant Conservator of Forests, Coorg, is granted three months' privilege leave from the 9th June 1879.

9.—BOMBAY GAZETTE.

No. 1944.—*12th April 1879.*—*Mr. W. S. Hexton*, Deputy Conservator of Forests, having returned to the Presidency on the 26th March 1879, the unexpired portion of the sick leave for eighteen months granted to him from the 1st June 1878, is cancelled, and he is allowed fifteen days' subsidiary leave.

No. 2186.—*24th April 1879.*—In continuation of Government Notification No. 6656, dated 26th December 1878, His Excellency the Governor in Council is pleased to confer the power of accepting money under Section 67 of the Indian Forest Act, 1878, on Conservators, Deputy Conservators and Assistant Conservators ex-officio with the proviso that the Conservators are to withhold the power from any Assistant Conservator to whom they consider it undesirable to entrust it.

2. Government are also pleased to appoint Conservators, and Deputy, Assistant and Sub-Assistant Conservators to exercise the powers of a Forest Officer under Sections 55 and 56; the principal Forest Officer of a District to exercise the powers of a Forest Officer under Sections 24, 25, 33, 36, 37, 38, 50, 71, and 82; and Rangers, Foresters, and Forest Guards to exercise the powers of a Forest Officer under Sections 45, 52, 63, and 69 of the Act.

3. Conservators are also empowered ex-officio to exercise any of the powers assigned to their subordinate officers.

No. 2369.—*3rd May 1879.*—In exercise of the power conferred by Section 4 of the Indian Forest Act, 1878, the Governor in Council is pleased to declare that it is proposed to constitute the below-mentioned land a reserved forest in extension of the existing reserved forest of Gundi Bela, and to appoint the Deputy or Extra Assistant Collector for the time being in charge of the Hyderabad Taluka, Forest Settlement Officer, for the purposes set forth in Clause (c) of the said section.

Under Section 16 of the said Act the Governor in Council is also pleased to appoint the Collector of Hyderabad to hear appeals from any order passed by the said Forest Settlement Officer under Sections 10, 11, 14, or 15 of the said Act.

Specification of the land referred to in the foregoing notification:—

All that waste land situated in Deh Jam Shoro in the Hyderabad Taluka of the Hyderabad District in the Province of Sind, forming part of Survey No. 373 and measuring 1'927 acres 20

guntas or thereabouts, and comprised within the following boundaries (namely) :—

On the north the River Indus and the Gundi Bela.
On the south the River Indus.
On the east Deh Jam Shoro.
On the west the River Indus.

No. 2478.—*9th May 1879.*—*Mr. T. B. Fry*, Assistant Conservator of Forests, 2nd Grade, is promoted to the 1st Grade, with effect from 12th April 1879.

10th May 1879.—*Messrs. T. B. Fry*, Assistant Conservator of Forests, and *Ganesh Krishna Shahane*, Sub-Assistant Conservator of Forests, respectively delivered over and received charge of the District Forest Office, Gujarat Circle, on the 3rd May 1879, after office hours.

No. 2227.—*Mr. W. S. Hexton*, Deputy Conservator of Forests, has been granted an extension for fifteen days to the subsidiary leave granted to him in Government Notification No. 1944, dated 12th instant.

No. 2652.—*20th May 1879.*—*Mr. C. Greatheed*, Assistant Conservator of Forests in Sind, is allowed furlough on medical certificate for six months, and subsidiary leave of absence for one week from the 5th instant.

Northern Division, 21st May 1879.—*Messrs. G. K. Betham*, and *G. E. Hewett*, Assistant Conservators of Forests have respectively delivered over and received charge of the District Forest Office, Khandesh, on the 3rd May 1879 after office hours.

WE regret that as we do not receive the "*Madras Gazette*" and the "*Gazette of British Burma*," we are unable to give notifications from these provinces.—ED.

THE
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Vol. V.]

OCTOBER, 1879.

[No. 2.]

Report on the Mahasu Water-Catchment Area, near Simla, by B. Ellis, Assistant Conservator of Forests, Punjab, dated Simla, 29th September 1877.

THE area it was originally proposed to take up, and which amounts to 1,435 acres, has been demarcated by 90 dry-stone pillars, each of which bears a serial number.

2. It is understood that if control over this area is obtained by lease or otherwise, it will be managed as forest, with the view of obtaining some return in the shape of timber, wood, and other forest produce for the amount that will have to be paid for leasing or otherwise obtaining control over the land.

The boundary in the neighbourhood of the Dochi and Shaduli villages was found to be very tortuous and intricate; and it is necessary, in order to facilitate protection and management, to change its position in this locality by carrying it down the Dochi spur from pillar 53 to the main stream and up the opposite spur to pillar 65. The boundary thus changed will include an additional 95 acres, making the total up to 1,530 acres.

3. These 1,530 acres have, for convenience of description and estimation, been divided into the following nine blocks, viz.,—

- I.—Dochi.
- II.—Chini-ka-theka.
- III.—Kuphar.
- IV.—Gariach.
- V.—Binda.
- VI.—Chauki.
- VII.—Sbalapani.
- VIII.—Manglot.
- IX.—Charabra.

These blocks are shown on the accompanying map. They are not demarcated by pillars, but their boundaries consist of

paths or natural features which can be readily recognised on the ground.

4. The elevation of the Mahasu area is between 7,200 and 8,600 feet, and the average may be taken at 7,500 feet. As regards forest growth, it is situated chiefly in the zone of the deodar, the Himalayan spruce (*Abies Smithiana*), kail (*Pinus excelsa*), and the morn oak, locally called meru (*Quercus dilatata*.)

The Alpine oak (*Quercus semecarpifolia*) is found on the eastern border of the area at its upper limit, and the grey oak (*Quercus incana*) is met with in the lower portion.

Chil (*Pinus longifolia*) is not found above the lower boundary.

5. A study of the ground has led to the conclusion that it can best be divided into the following classes :—

- I.—Cultivation including fields and fallows.
- II.—Grass preserves.
- III.—Rock and waste land.
- IV.—Forest, consisting mainly of deodar poles, amongst which the dominant stems average from 25 to 35 years old. These have been called "first class deodar poles," and their age may be estimated at 30 years on an average.
- V.—Similar forest to the above, in which the dominant poles average less than 25 years old. These have been called "second class deodar poles." A few only of those cut were found less than 15 years old, and the age of the second class poles may be estimated at 20 years on an average. The forest under IV and V is not pure deodar; it contains a small but varying proportion of kail (*Pinus excelsa*), rau (*Abies Smithiana*), and meru (*Quercus dilatata*). The rhododendron is found here and there, particularly in Block I near Dochi village.
- VI.—"Inferior forest, first class," that is, all tree-covered areas which cannot be classed as IV and V, and in which a considerable number of trees are found suitable for fuel and conversion into charcoal.
- VII.—Forest similar to VI, but which does not contain many trees suitable for fuel and conversion into charcoal.

The forest classed under VI and VII is open and most irregularly stocked. It contains principally meru, deodar, kail, and a few scattered poplar with ban (*Quercus incana*) at the lower levels.

The meru and ban have evidently been pollarded from time immemorial. Some of these trees are large, but with few exceptions they are all gnarled and irregular.

The deodar and kail were all lopped annually for litter, fuel, and manure.

6. An estimate has been made of the area within each block, occupied by each of the above classes, and the results will be found recorded, block by block, in the following statement and brief descriptive account of blocks. For the purpose of determining the areas of the different classes of land, each block was divided into compartments, but it was found sufficient for the present purpose to draw up a descriptive account of blocks only.

The compartments, therefore, will not be further mentioned in this report, but they are quoted in the statements of stumps and poles examined.

The totals are as follows :—

		Acres.
I.—Cultivation (measured by patwaris)	...	301
II.—Grass preserves	...	34
III.—Rock and waste	...	246
IV.—1st class deodar poles	...	342
V.—2nd " "	...	194
VI.—1st class inferior forest	...	93
VII.—2nd " "	...	320
Total	...	1,530

Area Statement.

No.	Block.	ESTIMATED AREA IN ACRES OCCUPIED BY								NUMBER OF HOUSES BUILT.		RAV. 5 feet girth or over.	
		Cultivation.	Grass preserve.	Block and waste.	Deodar poles.		Inferior forest.		Total.	With mortar.	Without.		Fruit trees.
					1st Class.	2nd Class.	1st Class.	2nd Class.					
I	Dochi ..	61	..	38	..	46	..	19	164	2	1	1	470
II	Chun-ka-theke	16	..	83	58	47	..	30	234	2	21	5	15
III	Kuphar	19	..	58	21	11	10	21	140	..	..	..	85
IV	Gariach	64	30	28	70	30	25	21	258	9	4	6	15
V	Rinda	20	..	20	..	60	10	54	164	..	..	..	..
VI	Chauki	44	4	..	..	..	25	125	198	9	4	38	..
VII	Shalapsut	17	..	2	60	..	5	24	128	..	2	126	..
VIII	Manglot	52	..	2	61	..	8	..	113	1	9	..	83
XI	Charabra	18	..	15	62	..	10	26	131	1	7	12	..
TOTAL		301	34	246	342	194	93	320	1,530	24	89	197	688

DESCRIPTIVE ACCOUNT OF BLOCKS.

7. *Block I. Dochi.*—This block has a north aspect. Slope 25° to 40° . Soil good throughout, rich and deep in parts. The eastern portion is rocky and was evidently stocked a few years ago with a forest of large rau trees. The greater portion of it has been cleared for potato cultivation, but a large number (470) of rau trees are to be found in patches, others isolated. The greater part of the potato fields have lain fallow for some years, and there are now only a few under cultivation. To the west are situated the fields of the village of Dochi near the ridge, marked by a large and conspicuous walnut tree. East of Dochi is a forest chiefly consisting of deodar poles mixed with a large proportion of oak, kail, and rhododendron. Below the village there is a pollarded oak forest and rocky slopes with patches of scrub.

Block II. Chini-ka-theka.—This block extends from the main ridge at Chini-ka-theka to the main stream. The aspect is chiefly south-west, and the prevailing slope is 30° to 50° . Near the ridge are a number of potato fields which belong to Chini-ka-theka village, and at the lower part of the block are three hamlets with permanent fields producing wheat and the usual kharif crops. A large portion of this block is covered partly with grass and partly with scrub. Besides this, there are 105 acres stocked with deodar poles, of which 47 have been classed as second, and 58 acres as first class, and lower down there is inferior oak forest. The area entered as stocked with deodar poles in this block is full of stumps of large deodar trees, most of which have evidently been cut within the last ten or fifteen years.

From local information also it has been ascertained that most of the cuttings in this block were made within the last 15 years. On the other hand, most of the poles, which were examined here, showed considerably greater age; and it is, therefore, probable that at the time the fellings were made, a portion of the ground was already stocked with saplings and young poles. Strictly speaking, a portion of this young deodar forest, and perhaps the greater portion, ought to be classed as under ten years of age. The groups of poles are scattered over exten-

sive slopes which are more or less bare at present, but on which, under protection from cattle, deodar may be expected to grow up.

In classifying this forest as first and second class deodar poles, we have perhaps erred, but the error being in favour of the Rana, it was the safest plan to adopt.

Block III. Kuphar.—This block comprises the slopes extending from the main ridge to the Gariach stream, the prevailing aspect being north-west. The slope is from 25° to 50° . The whole ground is rocky and stony. The cultivation consists chiefly of potato fields, which are situated near the main ridge. The rest of the area consists of rocky and grassy slopes with scattered patches of deodar poles. There is a fine patch of fair sized, but pollarded oak trees near the stream. Eighty-five ran trees are found scattered over the upper portion of this block.

Block IV. Gariach.—Comprises north side of Gariach valley. Aspect south and south-east. Prevailing slope 15° to 45° . The north portion below the main ridge is occupied by a forest of deodar poles, some patches of which are compact; here the soil is rich and deep. The west portion consists chiefly of open forest, pollarded oak, mixed with deodar and kail; nearer the stream is a steep rocky slope with scattered deodar.

This block includes the permanent fields of Gariach and Paniala villages with some potato fields near the main ridge. Above the village of Gariach is a considerable extent of rocky and steep grassy slopes. There are also two patches of grass preserves (ghaini).

Block V. Rinda.—South aspect. Slope 20° to 50° . In the upper or north portion a good deodar pole forest with some kail intermixed. The rest consists chiefly of scattered patches of oak. A portion of the fields of the village of Palag is situated in this block.

Block VI. Chauki.—South and south-west aspect. Slope from 20° to 40° , more or less, covered with stunted oak. Occasionally patches of fine trees are to be seen, but they are invariably pollarded.

This block contains extensive cultivation belonging to the villages of Palag, Chauki, Kamali, Soag, and Sangri.

Block VII. Shalapani.—Aspect north-west. Slope 25° to 45° . The greater portion of this block is a fairly stocked forest of deodar poles with rich and deep soil. There is some open and pollarded forest in the south or upper part, and a portion of the fields of Sangri is within its boundary.

Block VIII. Manglot.—North aspect. Slope 25° to 50° . In the east corner is a small compact deodar forest. A large area of ground cut up by old and new potato fields on which are some marketable rau trees. A very fine patch of meru near the stream.

Block IX. Charabra.—South aspect. Slope 25° to 50° . Soil good, and ground well covered with deodar poles from the road to some distance in the direction of Saonti village.

The east faces of the small spurs which descend into the valley from the main ridge are nearly bare. Over the lower portions of this block the oak prevails, and the ground is rocky.

8. In and about the cultivation were found to be 63 houses and 187 fruit trees, chiefly walnut and apricot.

It was determined to count all sound, well-grown, and marketable deodar and rau trees within the area, the minimum girth at breast-height from the ground being fixed in the case of the former at $4\frac{1}{2}$ and in that of the latter at 5 feet. All the standing deodar trees of this size were found to be crooked or hollow (badly grown); but there were 668 rau trees, viz., 470 in block I, 115 in blocks II, III, and IV, and 83 in block VIII.

9. The cultivation has been entered as 301 acres in accordance with measurements made by the patwaris, deputed by the Deputy Commissioner. This area consists partly of permanent fields which produce wheat and the usual kharif crops of the district, and partly of potato fields and land originally cleared for potato cultivation, but on which no crop is grown at present.

10. The houses have been entered in two classes; of the better kind built with mortar, there are 24, and without mortar 39. Some of the houses, such as those of Palag, are large and well built.

It may here be mentioned that a portion of the inhabitants were not originally men of the district, but have within the last 30 years come from other parts, chiefly from Suket and Mandi, and have settled here.

Besides the people from Suket and Mandi, who have settled here permanently, there is a considerable floating population, chiefly people from Kulu, who are employed as labourers in the potato fields. Most of them reside at Chini-ka-Theka, a portion of which settlement is within the area. Some of the inhabitants of Chini-ka-Theka are engaged in carrying timber to Simla from the Cheog and Khalashi forests.

11. There are 34 acres of grass preserves (ghaini), and they are valuable, as they furnish the chief supply of winter fodder for cows and bullocks. No cattle are allowed to enter these preserves from spring till the grass is cut in November, when the hay is stacked in the villages.

12. An area of 246 acres is occupied by "rock and waste." This comprises the greater portion of the precipitous and rocky slopes, where nothing grows except scrub and grass. This ground is of value to the villagers for pasture, and some of it might with care eventually be converted into forest. It will therefore be convenient in the calculation to consider it together with the forest lands.

13. The greater portion of the Mahasu area is stocked with forest, of which 536 acres are chiefly deodar and 413 acres a mixed forest, mostly open, of oak, deodar, and kail. This area of 949 acres, together with the 246 acres of rocky waste, have hitherto yielded, and may again be made to yield, the following descriptions of forest produce and revenue.

The inhabitants of the villages and bazar in the vicinity have been in the habit of grazing their cattle over the whole area, and of pollarding the oak trees to obtain fodder, chiefly for sheep and goats, and of lopping deodar and kail for litter and manure.

The forest also furnished them with wood for buildings and articles of husbandry. A small quantity of scrub, thorns, and branches was also used by them for fencing.

14. So far as we have ascertained, the Rana derives forest revenue from timber, firewood, and charcoal. For trees cut for "fuel" or "charcoal," the rate paid is Re. 1 for an aggregate girth of 7 feet, so that for three trees of 4.2 and 1 foot girths, the sum of Re. 1 would be paid. The demand for fuel and charcoal is, however, limited, and only a small number of trees is sold annually.

No revenue on account of timber has been realised for a considerable time, probably not for the last ten years. It is very remarkable that there are very few, if any, fresh cut stumps in the whole area. The latest important cuttings were, as already mentioned, in block II, and these were made about ten years ago.

15. Under these circumstances, the revenue at present realised from this forest can give us no indication as to its value. If the forest, with which a portion of the area is stocked, consisted of a regular gradation of ages with proportionate areas of mature, middle-aged, and young growth, the procedure for making a valuation would be to frame a regular working plan, and thereby determine the proper annual yield of the forest; and the value of this yield, according to the demand and state of the market, after deducting the cost of management, would be the annual rent of the forest.

16. Instead of a regular gradation of ages, however, we have a forest most thinly stocked, and of most irregular character, which for a long time to come will not yield marketable timber.

As regards timber, deodar is the only kind for which a regular demand may be said to exist. It is true that a considerable quantity of rau timber is brought to Simla for sale, and a portion of the large rau trees which stand in block VIII might, perhaps, be sold at the present time, but certainly purchasers could not be found for all of them, and it is very doubtful whether any of the large rau trees in blocks I, II, III, and IV are saleable. Nevertheless, it is right that the proprietor should have the benefit of the doubt. These trees will, therefore, be included in the valuation. The total number is 668, and it will be assumed that only 25 per cent. will decay, or for

other reasons remain unsold; further, that the remaining 500 trees will be sold within the next ten years, or, on an average, five years hence.

The data we have been able to collect regarding the rates paid to the neighbouring Rana of Keunthal for rau trees are as follows :—

				Rs.	As.	P.
Girth	4'	...	...	...	1	0 0
"	5'	...	...	...	1	8 0
"	6'	...	...	...	2	0 0
"	7'	...	...	...	2	8 0
"	8'	...	...	...	3	0 0

Accordingly, we have assessed the standing marketable trees at Rs. 3 each. The anticipated present value of this timber will therefore be as follows :—

Value of 500 trees at Rs. 3 each=Rs. 1,500 saleable five years hence, the present value of which at 5 per cent. compound interest is Rs. 1,175.

17. No marketable deodar trees were found, and the safest plan to determine the value of the forests of deodar poles seems to be the following :—

The smallest girth of a marketable deodar tree is at present $4\frac{1}{2}$ feet. In order to ascertain the age at which this size is reached, a number of old deodar stumps were planed and the rings counted.

The rings were counted on a mean radius of 9 inches, and the results are as follows :—

Record of Rings counted on Deodar Stumps.

Block.	Compartment.	No. of rings up to an average radius of 9 inches.	REMARKS.
I	b	54	} Soil deep. Slope 15° Soil rich and deep. Slope 35°.
	c	77	
		89	
IV	k	84	} Isolated. Ground flat & stony.
		79	
	l	104	} Soil rich. Rocky. On main ridge. Soil good. Soil deep. On edge of main road.
		101	
V	n	119	
		82	} Ground Rocky. Easy slope.
		77	

Block.	Compartment.	No. of rings up to an average radius of 9 inches.	REMARKS.
VII	s	81	Slope 25° to 30°. Good soil.
		79	
		72	
VIII	u	73	Rocky. Good soil.
		89	
IX	a	105	Very stony. Slope 20° to 25°.
		111	
		87	Average number of rings.

NOTE.—An exceptionally slow grown tree, in a ravine on very rocky ground with 172 rings on a mean radius of 9 inches, was excluded.

18. Thus it will be seen that the average of seventeen trees examined gave 87 years as the age of a tree $4\frac{1}{2}$ feet in girth, and the height of stumps where the rings were counted was 1 to 2 feet; so if allowance be made for the bark, the trees at that age would measure about $4\frac{1}{2}$ feet girth, breast-high.

This gives a somewhat slower rate of growth than was obtained in previous years by the counting of rings at Simla and in the Cheog forest near Fagu.

		Number of trees.	AGE OF TREES.	
			IN GIRTH.	
			6 feet.	$4\frac{1}{2}$ feet.
Bashahr Report, 1865, page 56 ...	{ Cheog, 1864. Trees 91 to 270 years old ...	5	110	87
	{ Simla, North aspect. Trees 24 to 91 years old ...	23	99	73
Ditto ditto, page 57	{ Simla, North aspect. Trees 66 to 153 years old ...	7	71	52
	{ Simla, South aspect. Trees 31 to 100 years old ...	9	91	67
Note on deodar localities near Simla, 1867 ...	{ Cheog, 1867. Trees 83 to 160 years old ...	9	95	70

The difference is readily explained by the higher elevation. The average elevation of the Mahasu area may be taken at 7,500 feet, whilst the elevations at which the rings of deodar stumps were counted in the Cheog forest was about 7,000, and at Simla below 7,000 feet.

It has been decided to assume 80 years as the mean age at which the deodar will attain a girth of $4\frac{1}{2}$ feet in the Mahasu area. The assumption is most favourable to the proprietor.

NOTE.—The girth, $4\frac{1}{2}$ feet, which is measured outside the bark and usually breast-high from the ground, gives, on the supposition that the horizontal section is circular, a diameter of 17·2" and a radius of 8·6". A tree measured in this way would have a considerably larger radius at 1 to 2 feet from the ground, the height at which trees are usually felled; and when counting rings on stumps, it is a sufficiently near approximation to assume that a tree having a mean radius of 9" without the bark at 1 to 2 feet from the ground, at breast-high, have a mean radius of 8·6", including the bark.

19. It has already been stated that we have divided the forest stocked with deodar poles into two classes, the average age of the first class poles being 30, and of the second class 20 years. It has also been mentioned that a considerable area in block II has been included in the second class, although its average is probably considerably under 20 years.

The details of the examination of these pole forests will be found in Appendix A of this report. It will be seen that the average girth and height of the poles examined range between the following limits :—

			Mean height.	Mean girth.
Second class, 20 years	...	...	28	17
First class, 30 years	...	...	34	21

Assuming 80 years as the age of a tree $4\frac{1}{2}$ feet girth, it is evident that the poles of the first class will take 50 years, and those of the second class 60 years to attain this size. Trees of that age will probably not reach more than 80 feet in height in the Mahasu area on an average.

20. The question next to be considered is how many mature trees there will be per acre at the assumed age of 80 years.

On this point, as the area in question contains no mature trees at all, no data are available, and we must be guided by information obtained in other localities of similar position.

The following is a statement of sample areas examined in 1863 and 1864 in Jaunsar and Kanawar, to which two sample areas have been added which were lately examined in Annandale, Simla.

Extract from page 10 of Bashahr Report, 1860.

			<i>Trees per acre.</i>		Total.
			First class, above 6 feet girth.	Second class, 4½ to 6 feet girth.	
Mayshak	...	} <i>Jaunsar</i>	14	39	53
Above Khuttowa village	...		43	26	69
Chilara jungle	...		32	38	70
Nachar forest	...	} <i>Kanawar</i>	36	8	44
Kiuden Forest	...		58	33	91
			36	21	57
Annandale	...	} <i>Simla</i>	33	7	40
			7	21	28

All these sample plots were selected in nearly completely stocked forests and on easy slopes. With very few exceptions the deodar pole forest in the Mahasu area are not completely stocked and are on steep and often rocky slopes, where, under the most perfect management, large blanks are unavoidable. A glance at the statement shows that in completely stocked areas the number of trees above 4½ feet girth is between 40 and 91 trees per acre. The last plot in the statement (in Annandale), which only contains 28 trees of that size per acre, has not been included, because the forest is not mature, and contains many trees of smaller size.

21. Considering elevation, soil, and other circumstances, we are not justified in expecting that the very best plots in the Mahasu area will contain more than 50 mature trees per acre; and taking into consideration the large extent of blanks and the irregular character of the forest, it will be a liberal allowance to assume that at the age of 80 years the forest will contain 20 trees per acre in girth 4½ feet and upwards.

The system on which the forests in the vicinity of Simla have been worked hitherto, was to cut each tree that had attained a marketable size. The cuttings at Mahasu only

ceased when there was no more timber to be cut, and will recommence when the first poles have attained a marketable size.

Under this system an area stocked with deodar has an intermittent yield, and though circumstances vary, we may roughly assume that, commencing from the age of 80 years, the forest will continue to yield timber for a period of 40 years, after which there will be an interval of no yield. Under this system we have a succession of crops, each spread over a period of 40 years, with blanks between, of about the same length of time.

22. Before commencing to calculate the present value of the forest under this system of working, it will be necessary to fix the rate at which the value of the standing trees shall be estimated. Here again we have no data to guide us with reference to the Mahasu forest, as no timber has been felled there for the last ten years; so we must base our calculations upon the rates which prevail in the two neighbouring forests of Cheog and Khalashi, both situated in the territory of the Rana of Keunthal. The mean distance of the Cheog forest from Simla is 14 miles, and Khalashi is about the same. The mean distance of the deodar forests in Mahasu area from Simla may be put down at 8 miles.

23. Regarding the rates which were paid to the Rana of Keunthal ten years ago, reliable data are recorded on page 9 of "Notes on Deodar Localities," by Dr. Brandis, 1867, and they were as follows:—

					Rs.	A.	P.
Girth 4'	...	...	...	...	1	2	0
" 5'	...	...	...	...	2	4	0
" 6'	...	...	...	...	3	6	0
" 7'	...	...	...	...	4	8	0
" 8'	...	...	...	...	5	10	0
" 9'	...	...	...	...	6	12	0

the girth being measured breast-high. According to information collected from various sources, the present rates are about double those of 1867.

Trees 4 feet in girth are paid for at rates which, according to the most reliable data, vary from Rs. 2-4 to Rs. 2-8, and for every additional foot girth the same rate is added.

For our present purpose we take the higher rate of Rs. 2-8 per foot, and making allowance for the lesser distance, the rate for the two classes of trees, if they existed at present in the Mahasu area, would be—

			Cheog.	Mahasu.
			Rs. As. P.	Rs. A. P.
Girth 4'	...	...	2 8 0	4 0 0
" 5'	...	...	5 0 0	7 0 0
" 6'	...	...	7 8 0	10 0 0
" 7'	...	...	10 0 0	13 0 0

24. The question now arises whether we have reason to expect that these rates will have increased considerably by the time that the trees in the Mahasu forest have attained marketable size. The increase of rates during the last ten years may be ascribed to the large increase of timber exported to Umballa from Simla, and to the circumstances that latterly not much of the timber floated down the Sutlej river has been available for the requirements of the Umballa market.

The fellings of deodar in the Sutlej forests have been very limited of late years, and will now doubtless be steadily increased. On the other hand, most deodar localities near Simla are approaching exhaustion. Under these circumstances, 50 per cent. will be added for the purpose of the present calculation to the rates estimated for the Mahasu forest at present. The result is, that trees of 5 feet girth, which may be felled when the first crop is cut, will be assessed at Rs. 10-8, trees 6 feet girth at Rs. 15, and those of 7 feet girth at Rs. 19-8.

25. It has been estimated that 20 marketable trees per acre will be available for cutting when the forest attains the age of 80 years; besides these 20 trees, however, there will be a large number of smaller ones, which will gradually attain a marketable size.

Considering the present state of the forest, it will be a liberal estimate to assume that the first crop will consist of 40 trees per acre which would be removed during a period of 40 years, i.e., from the time that the forest attains a mean age of 80, to the time when it has attained an age of 120 years. During this period of 40 years, the average girth of the trees may be esti-

mated at from 5 to 6 feet, and accordingly each tree will be assessed at Rs. 15.

The average outturn per tree of marketable timber cannot be estimated at more than 50 cubic feet, and a royalty of Rs. 15 per tree of that size would be exceedingly favourable for the proprietor, and never be realized.

26. It has before been shown that there are 342 acres of first class deodar poles which will reach an average age of $\frac{100+80}{2} = 90$ years 70 years hence, and will then, at Rs. 15 per tree, be worth Rs. 600 per acre, or Rs. 2,05,200 for the entire area. The 194 acres of second class poles will reach the average age of 100 years 10 years later, and will then at the same rate be worth Rs. 1,16,400. This large outturn can only be expected if the forest is protected from all injury. Unless fires are excluded, lopping strictly prohibited, and cattle excluded, except in compact pole forests where there is no young growth to damage, this outturn will not be realised. Some allowance must, therefore, be made for the expense of protection and also to cover risk of injury by storms and possibly by insects. Again, there will be some outlay connected with the control and cost of collecting so large a revenue during a period of 40 years.

27. A detailed estimate of these deductions is obviously not practicable; it will, therefore, suffice to make a deduction of 10 per cent. from the gross revenue. This gives—

	Rs.
Net value of 342 acres of first class deodar pole forest, 70	
years hence 	1,84,680
Net value of 194 acres of second class deodar pole forest, 80	
years hence 	1,04,760

28. This is the future value of the forest; and in order to reduce the future to the present value, it must be decided what percentage should be taken to effect this reduction.

In similar calculations in connexion with the valuation of forests on the Continent of Europe, it has generally been agreed to use 3 per cent. The current rate of interest in India is, however, much higher, and it will be more appropriate here to use 5 per cent. for making the calculation of the present value.

This rate has already been adopted (in paragraph 16) in calculating the present value of the rau trees.

29. Using the formula $v = \frac{f}{(1+r)^n}$, where v represents the present, f the future value, r the rate of interest, and n the number of years hence at which the forest will attain its estimated future value, we find the present value of the—

				Rs.
342 acres of first class deodar poles to be	...	...	...	6,082
194 „ of second class „ „	...	...	...	2,116
The present value of the entire crop of deodar poles will therefore be				8,198

30. This is the present value of the first crop which is expected 70 and 80 years hence. A second crop may be expected after a further interval of 100 years, provided the forest is efficiently protected and the cuttings are arranged with due regard to the regeneration of the forest, a sufficient number of seedling trees being left long enough to stock area with young growth.

The present value of the second crop must palpably be insignificant. It will suffice to say that the second crop, which would be available 100 years after the first, will, at the rates here taken, be worth under Rs. 70 at the present time, so this amount may be neglected in the present calculation.

31. We have thus obtained the following figures as representing the present value of 536 acres of deodar forest:—

				Rs.
Rau (<i>Abies Smithiana</i>)	...	...	...	1,175
Deodar	...	...	...	8,198
Total				9,373

At 5 per cent. this corresponds to an annual rent of Rs. 469, or about 14 annas per acre.

Part of the land on which the rau trees stand is outside the deodar forest and is classed as fields and fallows. On the map the patches of forest or diverted fields stocked with rau forest are separately indicated.

32. The remaining areas of inferior forest, rock, and waste must necessarily be assessed at a lower rate per acre than the deodar pole forest. There are no data upon which a valuation of these areas might be based, and accordingly it is proposed to assess them as follows :—

			Rs. A. P.
Inferior forest, first class, 93 acres at 8 annas	...	46	8 0
Ditto second „ 320 „ 6 „	...	120	0 0
Rock and waste, 246 „ 2 „	...	30	0 0
<hr/>			
Total annual rent for 659 ditto	...	197	4 0
<hr/>			

Adding Rs. 469, the rent of 536 acres of deodar pole forest, we obtain a total of Rs. 666 annually for 1,195 acres of forest, rock and waste.

No attempt has been made in this report to assess the 301 acres of fields and fallows, the 34 acres of grass preserves, and the houses and fruit trees ; the valuation of this property will be made by the Deputy Commissioner.

33. With regard to the estimate of rent which, under good arrangement and favourable circumstances, the forest and waste of the Mahasu area might be considered to yield to the Rana, it should be clearly understood that this amount will not be realised annually, but that it merely represents a rent equivalent to the future yield of the forest, the rate of interest being taken at 5 per cent.

34. The question now arises, how much Government can afford to pay for this area. The amount must obviously depend upon the consideration of the following data: *first*, the value to Government of the water-supply; *second*, the revenue which may be expected from the area; and, *third*, the outlay requisite for protection and management, and for increasing the productiveness of the forest.

35. It is understood that the area will be managed as forest, and it will be necessary briefly to state what outlay will be required to plant up those portions not at present stocked, so as to convert as large an area as possible into productive forest. The following remarks are submitted on the assumption that the

area will be placed under efficient provisional management, which means that it will be under the exclusive control of the Conservator of Forests.

The task of producing sufficient income from the forest to cover even part of the annual payment that will have to be made for the lease will not be easy; it will require considerable professional skill, efficient management, and a steady adherence to the plan of operations laid down after the needful experience has been gained, and this cannot be attained if the control is in any way divided or not placed in competent hands.

36. The first measure will be to enforce complete protection against fires, grazing, lopping, all kinds of cutting, the removal of dry leaves and surface soil. For this an establishment of one forester (say on Rs. 30 a month) and three forest guards (aggregating Rs. 20 a month) will be necessary. The pay of these men entails an annual outlay of Rs. 600. For fencing in places exposed to cattle, for the maintenance of boundary marks, and inspection paths, occasional extra watchers, and other minor outlay, a further sum of Rs. 150 annually must be allowed, making a total outlay on this account of Rs. 750 per annum.

37. The next step will be to plant up fields and fallows and that portion of the "rock and waste" which can, with advantage, be planted up; a considerable portion, say one-half of the "rock and waste," will probably always remain blank, and this, together with the existing "grass preserves" and certain plots of land included under "cultivation" and "inferior forests," it will probably be more advantageous to retain under grass. The grass lands will greatly benefit by complete exclusion of cattle and fires, and an attempt should be made to further improve them by the removal of stones and the cutting of scrub. The crop will be sold standing in autumn, and it will yield a fair income, which under good management may rise to Re. 1 per acre a year.

38. We should not be far wrong if we estimate that of the total area of 1,530 acres, 1,200 acres will be stocked with forest, and 330 acres will be under grass, including rocky precipices upon which scarcely anything will grow.

Of the 1,200 acres intended as forest, 949 acres are already entered as such; but as previously explained, these contain many large blanks, some of which must be planted up. For the purposes of this estimate, it may be assumed that 400 acres will require to be planted up.

39. The entire area is situated within the zone of deodar; the soil is favourable for its growth, and deodar is the tree which pays best, so there can be no question that it should be the chief species to be cultivated in this locality.

It is not intended to advocate the creation of pure deodar forests, but there is on the ground a large stock of oak (*Pinus excelsa*) and rau, amply sufficient to prevent the growing up of a pure deodar forest. The result will be a suitable mixture of oak and pines with deodar.

It may be assumed that three years will be required for preliminary arrangements, undertaken with the view of determining the most economical and efficient method of raising deodar in this locality by planting or sowing. After this experience has been gained, the work may be accomplished in three years more. So the total outlay, which, for the purpose of this calculation, may be taken at Rs. 30 per acre, including the cost of professional supervision, will be distributed over the first six years. Thus the area has to be charged with an outlay of Rs. 12,000, on an average three years hence, equivalent at 5 per cent. to a present outlay of Rs. 10,365, and at the same rate of interest to an annual outlay of Rs. 518.

40. Some further allowance must be made for periodical inspections by a senior officer of the department. The area is so small that it will not be necessary to charge it with a percentage of the Conservator's pay and establishment, but a contribution to the pay and travelling allowance of the divisional officer should be included.

Allowing for this, the total annual outlay will stand as follows:—

					Rs.
For protection	...	...	...	...	750
Control and inspection	...	...	...	...	232
Improvement	...	...	...	...	518
			Total	...	1,500

41. Thus the annual outlay on establishment is estimated at Rs. 982 per annum. This is large in proportion to the small area of 1,530 acres. A larger area might be managed by the same establishment without additional cost, and under these circumstances it would be a great advantage if an addition could be made to this area. There are two plots stocked with a promising Forest of deodar poled, which might advantageously be added: one is situated below the village of Sangri and measures 68 acres; the other occupies the north face of the Mahasu ridge between Mr. Batten's house and the Raja's bungalow, with the old Mahasu level road as the lower boundary, and is in area 137 acres. To this last-named block may advantageously be added an area of triangular shape, situated below the road, with good soil and stocked with deodar and *Pinus excelsa*. The area of this plot may be estimated at 50 acres, but it has not been included in the following remarks:—

42. Annexed to this report (Appendices E and F) is an area statement and brief description of the two proposed additional blocks, of which the following is an abstract:—

					Acres.
I. Cultivation	...	...	...	...	4
II. Rock and waste	...	...	...	...	93
III. Deodar poles, 1st class	...	...	...	...	158
IV. Inferior forest	...	...	...	...	10
Total				...	<u>205</u>

The "rock and waste" is all in the Mahasu block, and will stock itself with deodar and *Pinus excelsa* if cattle are excluded. No outlay need be incurred on cultivation, and the addition of these blocks will increase the area of forest stocked with deodar poles from 536 to 694 acres.

43. If this addition were made, the total area would stand as follows:—

					Acres.
Forest	..	...	...	...	1,400
Grass and waste	...	...	...	...	335
Total				...	<u>1,735</u>

Proportionately, a much larger amount might be paid for the area with these additions than without them. The future value of the growing stock of deodar on the additional area stands thus. On the assumption of the same royalty (Rs. 15) per tree, the same number of trees per acre and the same periods, the value of the deodar standing on 158 acres will, 70 years hence, amount to Rs. 94,800, or, deducting 10 per cent., to Rs. 85,320, which corresponds to a present value of Rs. 2,807, or to an annual rent at 5 per cent. of Rs. 140.

On account of 170 large rau trees standing among the deodar poles, and the remainder of the area (47 acres), an addition of Rs. 40 annually may be made, bringing up the total rent, corresponding to the additional 205 acres, to Rs. 180. Accordingly the rent of the total area of forest and waste (including 4 acres of fields in the Talkinai Block) will stand as follows:—

	Rs.
Rau trees per annum	19
Forty-seven acres (including fields, 4 acres)	21
Total ...	40

	Acres.	Rs.
Blocks I to IX ...	1,195	666
Additional blocks	205	180
Total ...	1,400	846

But as the addition suggested will relatively reduce the cost of management, and largely increase the prospect of revenue, a larger sum than that here mentioned can be paid for the lease of it.

44. The estimate of revenue to be realised from the total area will be based upon the assumption that planting and sowing will be carried out as proposed, and that the additions to the area, here recommended, will be made.

It will be framed upon the assumption that there will be—

	Acres.
Forest ...	1,400
Grass and waste	335
Total	1,735

Of the land covered with forest, an area of about one-half or 694 acres is already stocked with deodar, and the rest is a

mixed forest with a proportion of deodar, part of which it is intended to plant up.

45. The annual revenue of the 694 acres of deodar forest, including rau trees, under the existing system of management, has already been determined at Rs. 628, as follows:—

		Acre.	Rs.
Original area	...	536	469
Additional area	...	158	159*
Deodar forest	...	694	628

Under good professional treatment this revenue may be considerably enhanced by efficient arrangements for cutting and carriage to Simla of the timber that may be obtained from the standing large rau trees, by thinnings of the deodar poles, and by the cutting out of the old trees for fuel and charcoal. A much larger revenue will result from adopting another system of working the deodar forest when it has attained maturity. It is not necessary here to enter into detail on this subject: suffice it to say that under good management the annual rent of 694 acres of deodar forest ought to be brought up to Rs. 1,600. The area stocked with mixed forest (706 acres), part of which is to be planted up, may, under careful management, be expected to yield Rs. 700. Add to this Rs. 300 as the yield of the grass lands, we obtain the following annual income which it may be expected will be realized:—

		Acre.	Rs.
Forest	...	1,400	2,300
Grass and waste...	...	335	300
Total	...	1,735	2,600

Debiting the cost of management estimated in paragraph 40 at Rs. 1,500, there remains Rs. 1,100, which may be regarded as the maximum annual amount available to be paid as rent

					Rs.
* Deodar	...	...	...	...	140
Rau...	...	...	...	...	19
Total	...	...	...	...	159

for the total area of 1,735 acres. This is Rs. 254 in excess of the amount stated in paragraph 43, *viz.*, Rs. 846, as the rent of forest, rock, and waste.

46. It is outside the scope of this report to discuss the value to Government of the area for the water-supply of Simla. Whatever sums have to be paid for grass preserves, fields, fallows, houses, and fruit trees must be regarded as a set-off against the advantages gained in this respect. If this view of the case be accepted, then it is clear that, provided the additional area is secured, and provided the whole area is placed under efficient and competent management, an annual amount, not exceeding Rs. 1,100, may be paid to the Rana on account of the area, exclusive of the sum paid for grass preserves, fields, fallows, houses, and fruit trees.

Thus, assuming that the amount paid for 339 acres of grass preserves, fields, fallows, including houses and fruit trees, is equivalent to an annual rent of Rs. 800, and that Rs. 1,100 are paid annually for 1,396 acres of forest, rock, and waste, or a total of Rs. 1,900 per annum for the total area of 1,735 acres, it may be expected that under good management Rs. 1,100 will be covered by the net revenue from forest and grass lands, while the balance, Rs. 800, must be regarded as the amount paid for the Simla water-supply.

The foregoing calculations have been based, in every case, upon assumptions as favourable to the proprietor as it was possible to make them. The value assigned to the land, in accordance with these calculations, must, therefore, be regarded as a maximum value, which should not be exceeded.

This report has been prepared under the advice and with the assistance of Dr. Brandis, Inspector General of Forests, and Captain Bailey, R. E., Superintendent of Forest Surveys.

NOTE.—It should be explained that the area, which is here spoken of as the 'Mahasu Water-catchment' area, is a tract of land on the Mahasu ridge beyond Simla, in the territory of the Rana of Koti, from whom it is leased in order to be reserved as forest round the springs and streams which supply the water for the Simla waterworks, now nearly completed.—*Ed.*

APPENDIX A.

MAHASU WATER-CATCHMENT AREA.

Register of Measurement of Sample Poles of Deodar felled.

Block.	Compartment.	Length of stem.	Girth 3 feet above ground.	Total number of rings	REMARKS.
I.	b.	28	16	17	Compact forest. Soil deep. Slope 25°.
		26	16	16	
		38	18	22	
		31	17	18	
	c.	45	23	20	Rather open. Soil deep. Slope 35°.
		40	25	33	
		37	24	22	
		37	18	25	
		21	14	13	
		20	12	10	
	d.	33	19	20.5	Rather open. Stony grounds. Slope 40°.
		28	18	25	
		24	17	15	
		17	14	24	
		27	17	19	
		30	19	26	
II.	e.	25	15	22	Compact forest. Rocky.
		25	17	22	
		28	16	32	
		32	24	35	
	f.	28	14	22	Compact forest. Soil good. Slope 15°.
		29	18	32	
		26	14	19	
		23	15	31	
	g.	21	11	23	Rocky. { NOTE.—This plot of 3 poles was omitted from the average, as the growth was exceptionally slow.
		23	13	25	
		22	12	14	
		21	14	15	
III.	h.	26	15	17	Soil poor. Stony ground. Slope 25°.
		23	14	16	
		23	14	16	
		23	14	16	
	i.	45	30	40	Compact forest. Soil deep and rich. Slope 25°—35°.
		38	24	23	
		42	20	34	
		50	30	38	
IV.	j.	44	27	31	Compact forest. Soil deep and rich.
		44	33	36	
		36	24	28	
		36	24	28	

Block.	Compartment.	Length of stem.	Girth 3 feet above ground.	Total number of trees.	REMARKS.
IV.	l.	52	29	35	Slope 25°—35°. Felled near pillar 16.
		45	38	39	
		41	43	36	
		43	30	34	Averages.
		29	19	33	Compact forest. Soil deep and rich. Slope 30°. Felled near pillar 16.
		34	18	36	
		29	22	40	
		31	19	38	
		32	21	41	
		24	17	28	
		31	20	32	
		31	19	24	
		28	23	27	
		24	17	22	
		30	19.5	32	Averages.
		29	17	23	Open forest. Ground stony. Slope 35°.
		24	13	26	
		26	21	31	
		35	18	35	
		32	17	36	
V.	m.	29	17	31	Averages.
		27	13	31	Open forest. Ground stony. Slope 35°.
		35	19	33	
		39	21	42	
		39	21	30	
		25	15	21	
		32	19	36	
		33	19	24	
		32	18	31	Averages.
		21	13	21	Soil deep in parts. Rather open. Slope 20°.
		22	14	22	
		30	24	36	
		26	16	28	
		22	15	21	
VII.	s.	36	25	25	Compact forest. Soil deep and rich. Slope 30°.
		26	18	25.5	
		25	21	29	
		29	17	24	Averages.
		35	29	30	
		33	21	31	Averages.
		30.5	22	28.5	

164 REPORT ON THE MAHASU WATER-CATCHMENT AREA.

Block.	Compartment.	Length of stem.	Girth 3 feet above ground	Total number of rings.	REMARKS.
VIII.	a.	23	16	30	Soil good. Rocky. Slope 20°.
		28	21	33	
		22	12	23	
		42	27	32	
		19	9	16	
		27	17	28	Averages.
IX.	a.	41	19	26	Stony. On spur near pillar 80°.
		54	24	33	
		51	28	36	
		56	30	36	
		49	26	35	
		50	25	34	Averages.
		50	25	33	
		31	19	33	
		29	19	37	
		31	15	35	
		27	16	26	Very stony. On spur near pillar 80°.
		25	18	41	
		29	17	35	Averages.

APPENDIX B.

Rates at which Sawn Timber is sold in the Lakri Bazar, Simla.

		Rs. As. P.		
Beams under 3 cubic feet	0 14 0	per cubic foot
„ 3 to 5 „	1 4 0	„
„ 5 to 8 „	1 8 0	„
„ 8 to 12 „	1 12 0	„
„ 12 to 16 „	2 0 0	„
Kurries 16' by 6" × 4"	0 14 0	„
„ „ by 6" × 5"	1 0 0	„
„ „ by 8" × 6"	1 4 0	„
Planks 9' × 10' long by $\frac{3}{4}$ thick	1 0 0	„
Ditto by $1\frac{1}{2}$ to 2 thick	0 13 0	„

APPENDIX C.

Information obtained of the rates paid for standing Deodar Trees in the Cheog and Khalashi Forests of Kuenthal.

From whom the information now obtained.	Name of Forests	Girths.	Rate.	REMARKS.
			Rs. As. P.	
Mr. McGregor, Inspector of Simla Municipal Forests ...	Cheog.	4	2 5 0	These rates are confirmed by Bannia Lena of Lakri Bazar, Simla, and by the mahajans of Junga in Kuenthal.
		5	4 10 0	
		6	6 15 0	
		7	9 4 0	
Bannia Sucha of Lakri Bazar, Simla ...	Cheog.	8	11 9 0	
		4	2 8 0	
		5	5 0 0	
		6	7 6 0	
From local sources ...	Khalashi.	7	10 0 0	
		8	12 8 0	
			Tall trees.	
			Short trees.	
			Rs. A. P.	
		4	2 8 0	2 4 0
		5	5 0 0	4 8 0
		6	7 0 0	6 12 0
		7	10 0 0	9 0 0
		8	12 8 0	11 4 0

APPENDIX D.

MAHASU AREA.

Estimated Statement of Rates of growth of Deodar.

Age.	Girth.	Height.	REMARKS.
Years.	Inches.	Feet.	
20	17	28	} Result of the examination of 79 poles as recorded in Appendix A.
30	21	34	
80	54	80	
120	78	90	

APPENDIX E.

MAHASU WATER-CATCHMENT AREA.

Area Statement of additional blocks.

Number.	Block.	ESTIMATED AREA IN ACRES OCCUPIED BY								No. OF HOUSES BUILT.		No. OF MARKET- ABLE RAU TREES.		REMARKS.
	Name.	Cultivation.	Grass preserves.	Rock and waste.	Deodar poles.		Inferior forest.		Total.	With mortar.	Without mortar.	Fruit trees.	5 feet girth and over.	
					1st Class.	2nd Class.	1st Class.	2nd Class.						
X	Talkinai ...	4	...	...	58	...	6	...	63	1	...	11	...
XI	Mahasu ...	...	...	83	100	...	4	...	137	...	...	...	170
	TOTAL ...	4	...	83	158	...	10	...	205	1	...	11	170	

APPENDIX F.

BRIEF DESCRIPTIVE ACCOUNT OF ADDITIONAL BLOCKS.

Talkinai.

W. aspect, slope 25° to 45°. Soil rich and deep. A deodar pole forest nearly compact in centre. A good deal of oak (meru) is found intermixed with the deodar in the vicinity of the stream E. A patch of very fine oak.

Mahasu.

Principally a north-east aspect. Slope 30° to 50°. Three grassy slopes facing south-east, and a small area of oak. The rest is a fine, and in places compact, forest of deodar poles, here and there intermixed with poles of kail and rau. In the pole forest stand a large number of old and tall rau trees.

[*Note.*—It may be useful here to explain that the proposal to take in the Mahasu and Talkinai Blocks was afterwards negatived by Government, the original area only being leased.—Ed.]

**Iron smelting in Kotkai. By Captain J. Bailey, B.C.,
Conservator of Forests, School Circle, B.M.B.**

On the 14th April 1879, I visited a smelting furnace about two miles from Kotkai on the Jubal road, and made the following notes:—

The ore, which is of the kind known as “magnetic,” is taken from the mines mixed with a large quantity of fine light-colored sand; the ore and sand being in the proportion of about 10 or 11 to 100. A close inspection of the sand will show that it contains a fine dark (nearly black) powder which is the ore, and to separate which from the sand is the first object of the workmen. This is effected by washing the sand in a wooden trough, about 7 or 8 feet long, made from a hollowed tree, and through which a small stream of water is kept running. The operation of washing is conducted as follows:—

The lower end of the trough is at first stopped up with earth, and a quantity of the sand, from which the ore is to be washed, is put into its upper end. A man stands on this and kneads it with his feet. The particles of iron ore gradually sink to the bottom, and the water holding the sand in suspension passes down to the lower end of the trough, some particles of ore being deposited along the whole length of its bottom. A second man now opens the lower end of the trough and allows the dirty water to escape, sweeping the trough upwards with a small broom of twigs, so as to prevent any of the ore (which always lies at the bottom of the trough) from being washed out. A small stream of water is allowed to pour continuously in at the upper end of the trough, and the mass of sand and ore is continually turned over and kneaded until the sand has been washed out, stones, &c., being from time to time swept out or picked out by the hand. As soon as the ore has been sufficiently cleaned, it is removed from the trough and spread out in the sun to dry. When dry, it presents the appearance of a coarse nearly black powder, still slightly mixed with grains of sand. In this condition it is carried in a *kandi* or basket for a distance of about four miles to the furnace, where it is sold at the rate of 32 seers per 8 annas.

The ore is smelted in the following manner:—

A cylindrical clay furnace (A) about 4 feet high, and 5 feet exterior circumference at the top and bottom, but narrowed towards the centre, is mounted on a platform over an ashpit (C). The bottom of the furnace is stopped by a perforated

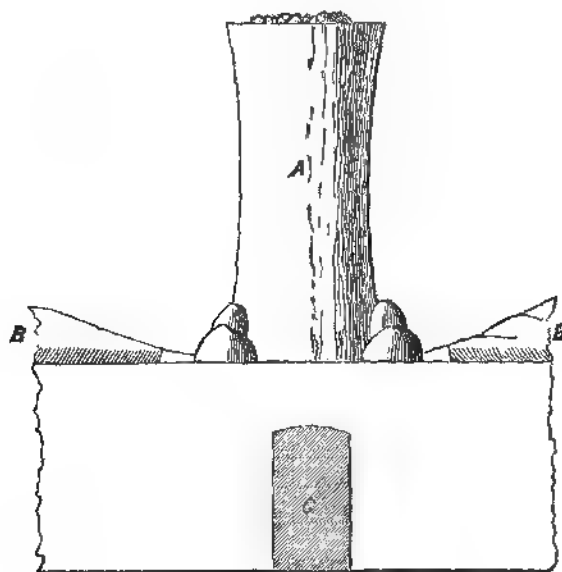


plate of clay which acts as a grating. At two opposite points of the circumference, and at the bottom of the furnace, burnt clay nozzles are inserted, the ends of them approaching within three or four inches of each other above the grating, and through these nozzles two pairs of goat-skin bellows (B B) are worked, a man sitting on the platform at each side of the furnace for the purpose.

Some pieces of lighted charcoal are put inside the furnace between the nozzles, and the bellows are worked, and charcoal added until the furnace is full to the top of burning charcoal. Some ore is now scattered on the top of the furnace with a small iron ladle, and the bellows are kept working. Every few minutes another ladleful of ore is added, and as the fire burns down more charcoal is added. The operation is thus continued throughout the entire day, the men (four in two reliefs) working from about sunrise to sunset. Every now and

then one of the holes of the grating is opened with an iron pin, and the "Slag" is allowed to run out. The iron does not run out, but remains in a mass on the grating at the bottom of the furnace, and is taken out in the evening by breaking the clay grating with the end of a pole. During one day about 32 seers of ore can be passed through the furnace, and the result is about 16 seers of iron, which can be sold for from Re. 1-8 to to Rs. 2. It will be seen that the ore is very rich, as by the process described it yields about 50 per cent. of iron, about 50 seers of charcoal are required for the day's work, which could not be continued much longer than from sunrise to sunset, because the burnt clay nozzles become worn out, and when this is the case the bellows cannot be worked, and the furnace must be emptied and refilled.

Pine Pollen and Sulphur.

By a coincidence which depends upon the season of pollen-discharge occurring at the same period in Scotland as in England, I am enabled to send you an extract from the *Haddingtonshire Courier* of June 27th, which may serve to dissipate the "sulphureous theories" of Mr. Carpenter's opponents:—

"The rustics in this district (Gifford) have been of late much interested in a peculiar shower which had fallen in the early morning of Monday last. All the pools on the roads were covered and fringed with a powdery substance strongly resembling the flowers of sulphur. A calculating Good Templar found that the fiery powder had been drifted more about the houses of those who loved the flowing bowl than those who loved the contents of the flowing river. One old woman, however, dispelled the Templar's idea by stating that she had felt the smell of brimstone near her dwelling, and on searching the premises it was found the water-barrel had got a saffron cap on, and was otherwise dusted with the subtle powder. As this mystery, if it is not explained, may prove serious to the nervous, superstitious, or credulous part of the community we may as well add that at this season districts in the neighbourhood of fir plantations run the risk of a thorough

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dusting of this powder if there is the slightest breeze, as the cones of the young Scots fir are thickly coated with yellow powder or pollen, which will give out a blinding saffron cloud on the slightest irritation."

The laudable desire of our newspaper correspondent to relieve the anxieties of his neighbours at a time when the Presbyterian world is much exercised over the question of eternal and sulphureous punishment, can be fully appreciated only by natives. But in my opinion the correspondent, in his clear knowledge of the nature of the "brimstone" deposit, exhibits a most praiseworthy tendency to explain the natural in terms of the natural; whilst the incident tends to show at the same time that there are not a few persons in this world to whom a course of elementary studies in natural history would serve as a means of culture, not to say of common protection against ludicrous mistakes, such as those against which Mr. Carpenter inveighs.

ANDREW WILSON.

Edinburgh Medical School.

[From "*Nature*," July 17th.]

The above extract may interest our readers as the discharge of yellow pollen in great abundance, from the *male* flowers (of the deodar especially) will often have been noticed by them. At Simla, in any October, the ground, road-side railings, &c., are often yellow with pollen. In Kulu I have observed that the people collect this, and mixing it with some glutinous substance employ it as paint to make patterns on their houses and temples.

B. H. B. P.

Forests of Central Nevada and Adjacent Regions.

BY CHAS. S. SARGENT.

(From "THE GARDEN," 2nd August 1879.)

To the traveller crossing the Great Basin by the line of the Pacific Railroad the country will appear almost as destitute of trees as the great plateau over which he has passed in approaching the Rocky Mountains from the east. This first impression will disappear, however, should he penetrate further south, and ascend some of the low mountain ranges, which, with a general north-and-south trend, everywhere cut up this elevated interior region into long, narrow valleys. As compared with our Atlantic forests, or those still nobler ones which, farther to the west, owe their existence to the influence of the Pacific, the forests which clothe, with a scanty and stunted vegetation, the mountain slopes of Nevada are miserably poor in extent, productiveness, and specially in the number of species of which they are composed. Actually they are of immense value. For scanty as they are, they regulate and protect the rare and uncertain streams on which the agriculture of Nevada depends, and furnish a large population with fuel and lumber; a population, too, which, while consuming and wasting enormously its forests in vast mining operations, is practically cut off, by its isolation and the cost of transportation, from outside supply.

A hurried journey made in September last, undertaken for the purpose of studying *in situ* the trees of the Great Basin, and of introducing into cultivation some of the peculiar plants of that region, took me to the great mining centre of Eureka, and then through Dry and Fish-spring valleys seventy-five miles further south-west into the Monitor Range, to the point where its highest peak, Table Mountain, reaches an elevation of 11,200 ft., and offered an excellent opportunity to examine the timber supply of that central portion of Nevada.

The forests of this portion of the State are composed of but seven species. Of these, two, the Red Cedar (*Juniperus virginiana*, L.) and the Aspen (*Populus tremuloides*, Michx.) extend across the continent; two, *Pinus Balfouriana*, Murr.,

and *Pinus flexilis*, James, extend along the mountain ranges from the Rocky Mountains of Colorado to Mount Shasta in California; two, *Pinus monophylla*, Torr., and *Juniperus californica*, Carrière var. *utahensis*, Engelm., are endemic to the Great Basin; while *Cercocarpus ledifolius*, Nutt., although occurring as a shrub both in the Rocky Mountains and in California, only here becomes a valuable tree.

Neither the Red Cedar nor the Aspen need be considered here. A single small plant of the former was noticed; and it is evidently so rare throughout this region that it adds but little to the value of its forests. The Aspen borders all the mountain streams above 8,000 ft. elevation, but, rarely surpassing 15 ft. in height and a few inches in diameter, is practically without value for its products. Further east in the Wahsatch Mountains, this species is sometimes seen with stems 2 ft. through; and it is largely used by the Mormons, who consider it valuable for flooring, turnery, &c.

Juniperus californica var. *utahensis* is the most common and the most widely distributed of the trees of this region. It is found at lower elevations than any other tree, and alone descends into the valleys, where, at elevation of 5,000 ft., it is often abundant, but less so than on the mountain sides, over which it spreads up to 8,000 ft. elevation. It is a low, bushy tree, branching from the ground, with a stout trunk which rarely exceeds 2 ft. in diameter; short and very stout branchlets, and thick shreddy bark. The wood, which is moderately hard, pale coloured, and slightly aromatic, furnishes the common and cheapest fuel both for domestic use and for generating steam on the railroads and at the mines. The typical *Juniperus californica* belongs to the Californian coast range, and the variety extends over the whole of the southern portion of the Great Basin. In fruit this species will be readily distinguished by its dry one-seeded berry, the great thickness of the stony coating of the seeds, and from all other Junipers (as pointed out by Dr. Engelmann) by its 4 to 6 cotyledonous embryo. Without fruit it may be easily confounded with *Juniperus occidentalis*, Hook., which species, however, has not been detected in Central Nevada. Like all

the trees of the Great Basin, this Juniper is of exceedingly slow growth. A specimen before me $4\frac{1}{2}$ in. in diameter shows 105 annual layers of growth, or an annual average increase of nearly one-fiftieth of an inch.

Growing with this Juniper, above 6,000 ft. elevation, and extending rather higher up the mountains, is *Pinus monophylla*, Torr., the Nut Pine of Nevada and Eastern California, but not to be confounded with an allied species, also bearing edible seeds, *Pinus edulis*, Engelm., found from Colorado to New Mexico and Arizona. *Pinus monophylla* is a small tree, 10 ft. to 20 ft. high, with reddish scaly bark, and is easily distinguished from other North American Pines by its solitary, glaucous, terete leaves (very rarely in pairs, and then semi-cylindrical). The wood is white, soft, light, and very resinous; it is more highly prized for making charcoal than that of any tree of this region. In slowness of growth *Pinus monophylla* does not essentially differ from the Juniper with which it is associated. A specimen that I have examined, from the locality which furnished the specimen of Juniper referred to above, is $5\frac{1}{2}$ in. in diameter, and shows 118 annual layers of growth. The immense crops of large and delicately-flavoured seeds produced by this tree supply, as is well known, to the Indian tribes of the Great Basin, their most important article of food. The value of this crop and the excellent quality of the wood for charcoal make this tree in a mining region entirely destitute of coal, its most valuable vegetable production. The introduction of *Pinus monophylla* into the south of Europe as a subject for forest planting is worthy of consideration; it might flourish there on those dry and exposed hill sides which have been found so difficult to satisfactorily re-cover with any European tree. Its strictly pyramidal habit while young—a habit which it entirely loses with age—and the pleasing glaucous tints of its foliage commend this species to the lovers of ornamental Conifers.

*PINUS BALFOURIANA** was only met with on Prospect

* With the insufficient material at my disposal I cannot satisfactorily separate *Pinus aristata*, Engelm. from Murray's *P. Balfouriana*, the older name, and founded on Californian specimens. *Pinus aristata* is an Alpine plant discovered by Parry many years later in the Rocky Mountains of Colorado.

Mountain, near Eureka, at an elevation of 7,500 ft., to the summit of 8,000 ft. Formerly the whole summit of this mountain was very generally covered with this species; but, with very few exceptions, the trees have all been cut to supply the mines with timbering, for which purpose the strong and very close-grained tough wood of this species is preferred to that of any other Nevada tree. The specimens seen were from 15 ft. to 30 ft. high, with trunks often 2 ft. in diameter, pyramidal in outline, their lower branches still remaining, so that at a little distance they might readily be mistaken for Spruces. The bark, like the wood, is reddish in colour, very thick, and deeply furrowed; that of the branches smooth and quite white. The short, falcate, adpressed leaves persist for years, forming tufts of foliage 1 ft. or more long at the ends of the naked branches; and this peculiarity has suggested to the lumbermen of the region the name of "Fox Tail Pine" for this species. *Pinus Balfouriana*, should it be found to retain in cultivation the peculiarities which characterise it on the mountains of Nevada, will be one of the most striking and interesting of the genus for ornamental planting.

PINUS FLEXILIS, the Nevada representative of the Eastern White and the Californian Sugar Pine, is the largest and the most valuable timber tree of the central portion of the Great Basin. I found large tracts of it on the Monitor Range from 8,000 ft. up to 10,000 ft. elevation; and further to the north-east it gives their names to White Pine District, White Pine Range, &c. On the Monitor Range specimens from 50 ft. to 60 ft. high and from 2½ ft. to 4 ft. in diameter were not unfrequent, the trees becoming smaller as the elevation increased, until at 10,000 ft. they were little more than prostrate bushes 1 ft. or 2 ft. high. The fact that the finest specimens were found on the banks of the mountain streams, associated with *Populus tremuloides*, indicates that this species is more dependent on moisture than the other Nevada Conifers. It is the only tree of this region which is sawed into lumber. The wood is soft, white, and, although not free from knots, is of fair quality, and about intermediate between Eastern White Pine and Sugar Pine.

CERCOCARPUS LEDIFOLIUS, with *Populus tremuloides*, the only non-coniferous tree of this region, here attains its largest size and greatest age. It is common at from 6,000 ft. to 8,000 ft. elevation, and, next to the Juniper and the Nut Pine, is the most common of Central Nevada trees. It is a small tree from 10 ft. to 30 ft. high, with small evergreen leaves and brown scaly bark, in habit and general appearance not unlike a stunted Apple tree. The wood of this tree, which is of a bright mahogany colour, and susceptible of a beautiful polish, is exceedingly hard, heavy, and close-grained, but very brittle, and so liable to "heart shake" and difficult to work as to be useless in the arts. It is, however, sometimes employed for the bearings of machinery, where it is found to wear as well as metal; but it is as fuel that "Mountain Mahogany" (the name of which, owing to the colour of its wood, *Cercocarpus* is universally known) has no North American equal. We are in the habit of considering that our Eastern Hickories produce the best fuel. The specific gravity of dry Hickory is but .832, while that of *Cercocarpus* is 1.117, so that, weight being the best test, as fuel it is worth 30 per cent. more than Hickory. The amount of ash, too, left after burning *Cercocarpus* is only 52-100ths of 1 per cent. of the dry wood consumed, while that of Hickory is 81-100ths of 1 per cent.; 3-10ths per cent. more. *Cercocarpus* is probably the only North American wood which is heavier than water; and among the tropical woods employed in the arts and described by Haslett, but six equal or surpass it, the most conspicuous being the West Indian *Lignum Vitæ* (*Guaicum*) with a specific gravity of 1.248. As was to be expected the growth of *Cercocarpus* was found to be exceedingly slow. An examination of several specimens from 100 to 200 years old shows an average annual increase of wood only 1-6th of an inch in thickness. The largest specimen of this tree was seen on Prospect Mountain near Eureka, in New York Cañon, at an elevation of 7,000 ft. It was a low, much branched tree, about 20 ft. high, with a trunk rising 6 ft. to the first branches. At 3 ft. from the ground it had a girth of 7 ft. 5 in. If we suppose that its average growth had been as

176 FORESTS OF CENTRAL NEVADA AND ADJACENT REGIONS.

rapid as that of the younger specimens examined, this tree would have been 890 years old. It was probably much older. The rate of growth of trees is, after a certain age, in inverse ratio to their age, and it is perhaps permissible to suppose that the seed which produced this little tree had already germinated when the oldest living Sequoia on the continent was still a vigorous sapling with its bi-centennial anniversary still before it.

Two shrubby plants of this region may be mentioned, which from their beauty are especially worthy of introduction to cultivation—*Cowania mexicana*, Don., a large Rosaceous shrub nearly allied to *Cercocarpus*, with elegant pinatifidly-lobed leaves and large and very abundant yellow flowers; and a large, shrubby *Spiræa* (*S. Millefolium*, Torr.), with the foliage of *Chamæbatia*, but a larger and more striking plant, and, perhaps, the most elegant of the genus.

It will have been seen that the forests of Nevada, consisting of a few species adapted to struggle with adverse conditions of soil and climate, are of immense age, and that the dwarfed and scattered individuals which compose them reach maturity only after centuries of exceedingly slow growth. On this account, and because, if once destroyed, the want of moisture will for ever prevent their restoration, either naturally or by the hand of man, public attention should be turned to the importance of preserving, before it is too late, some portions of these forests. Large areas of forest-covered mountain ranges are still held by the General Government, and in view of the vast importance of their remaining wooded to serve as reservoirs of moisture, on the existence of which the future of this region must depend, it would seem wise and not perhaps altogether impracticable to check or at least to regulate the terrible destruction of forest, which follows, both on public and private domain, every new discovery of the precious metals.

[NOTE.—We understand that the author of this paper is the Professor of Arboriculture in Haward University, U.S.A.—Ed.]

Rats in Brazil and their connection with the flowering of the Bamboo.

On this subject the following extract from the *Scientific American*, re-published in the *Pioneer*, may be of interest, especially now that the plague of rats is engrossing the attention of the Bombay authorities :—

“Mr. Orville A. Derby contributes to the *Rio News* some interesting information on the plague of rats in Brazil. From time to time, in all parts of Brazil the plantations are subject to the depredations of armies of rats that issue from the forests, and consume everything edible that comes in their way. During a recent excursion in the province of Parana Mr. Derby found an almost universal lack of corn throughout the province, due to such invasion of rats, by which almost the entire crop of last year had been destroyed. This invasion, or plague as it is called, is said to occur at intervals of about thirty years, and to be simultaneous with the drying of the *taguara*, or bamboo, which everywhere abounds in the Brazilian forests. The popular explanation is that every cane of bamboo sprouts with a grub, the germ of a rat within it, and that when the bamboo ripens and dies, the germ becomes a fully developed rat and comes out to prey on the plantations. An educated and observant Englishman, Mr. Herbert H. Mercer, who has resided a number of years in the province, and had an opportunity of studying the phenomenon, furnished Mr. Derby the following rational and curious explanation :—The bamboo arrives at maturity, flowers and seeds at intervals of several years, which doubtless vary with the different species. The period for the species most abundant in Parana is thirty years. The process, instead of being simultaneous, occupies about five years, a few of the canes going to seed the first year, an increased number the second, and so on progressively, till finally the remaining and larger portion of the cane seed at the same time. Each cane bears about a peck of edible seed resembling rice, which is very fat and nourishing, and is often eaten by the Indians. The quantity produced is enormous, and large areas are often covered to a

depth of five or six inches. After seeding the cane dies, breaks off at the root, and falls to the ground, the process of decay being hastened by the borings of larvæ, which live upon the bamboo, and appear to be particularly abundant at seeding time. These larvæ have doubtless given rise to the story of the grub developing into a rat. New canes spring up from the seed, but require seven or eight years to become fit for use, and thirty to reach maturity. With this sudden and constantly increasing supply of nourishing food for a period of five years, the rats and mice, both of native and imported species, increase extraordinarily in numbers. The fecundity of these animals is well known, and the result after four or five years of an unusual and constantly increasing supply of excellent aid in the absence of enemies of equal fecundity, can readily be imagined. The last of the crop of seed being mature and fallen to the ground, the first rain causes it to decay in the space of a very few days. The rats, suddenly deprived of food, commence to migrate, invading the plantations and houses, and consuming everything that does not happen to be repugnant to the not very fastidious palate of a famishing rodent. If this happens at the time of corn planting, the seed is consumed as fast as it can be put into the ground. Mr. Mercer, who plants annually about fifty acres of corn, re-planted six times last year, and finally gave up in despair. The mandioca is dug up; the rice crop, if it happens to be newly sown or in seed, is consumed, as is also everything in the houses in the way of provisions and leather, if not carefully guarded in trunks."

The Vegetation of the Kuram and Hariab Valleys.

By DR. J. E. T. AITCHISON.

Botanist to the Kuram Field Force, dated June 22nd.

Thull—Is a village on the Kuram river at an altitude of 2,500 feet, surrounded closely by low hills, the highest peak in its vicinity being that of Kadimuk, 4,900 feet. In the small basin of Thull the flora is peculiarly that of the Salt Range of the Punjab, consisting of a few stunted shrubs, with occasional trees near water. The hills are, with the exception of grass, nearly barren of anything like vegetation, and when it does exist, it is in hollows where shade and moisture can be obtained. Kadimuk would, from its altitude, if it were in the Punjab Salt Range, be much better clothed. Here already the crushing out effects of a winter, cold enough to deposit snow, and want of moisture in the atmosphere, point out why between this and the base of the Safed Koh Range there exists little or no natural vegetation. In summer for several months the climate is that of the Punjab—a dry tropical heat. There are few plants that can withstand these extremes of temperature. The result is that as we proceed towards the town of Kuram (4,800 feet), we find, except such parts of the country as are cultivated by irrigation, that it is treeless and almost a barren waste.

In the basin of Thull, where the Punjab forms, are nearly all present, the first characteristic one to be absent is *Capparis aphylla*. The olive is rare; from this to the village of Shaluzan I have only seen it near houses, and holy-places as *ziárats*, its place being taken by *Reptonia buxifolia*, which bears a remarkable resemblance to the olive. A little distance out of Thull in the more open country, *Daphne mucronata*, Royle, *Sophora mollis*, Wall., and *Cotoneaster nummularia*, Fisch., are the plants that make up most of the scrub jungles, and range from this right through the Kuram Valley up to the Hariab, all reaching to nearly 10,000 feet and form what little scrub there occasionally is amongst the pines at this high altitude.

In gradually ascending the Kuram Valley we soon lose our chief Punjab forms. At Ahmad-de-Shama, 8 miles from

Thull, *Acacia modesta* and *Dalbergia Sissoo* are last seen. *Periploca aphylla*, however, accompanies us to nearly opposite Kuram and in some quantity, being largely cut and collected as fodder for camels. The only occasional trees, except in the immediate vicinity of water, are *Pistacia integerrima* and a small *Rhus*. Wherever water is employed for irrigation there the crops are good and trees of various sorts rapidly spring up. At Hazir Pir Ziárat fine trees of *Platanus orientalis* and *Salix* are to be seen; these increase in number and size as we reach Kuram.

Up to this *Chamærops Ritchieana* has been more or less frequent, but from this it gradually disappears along the left bank, at least of the Kuram Valley, but is found forming a thick dense aloe-like scrub on the plateaux that lead west up to the Darwaza Gai Pass. When this palm is not injured or cut, it forms a branching tree of from 15 to 25 feet in height, as may be seen at many of the shrines between Kohat and this, or even within the walls of Peshawar near one of the gateways. It extends largely into the Khost country. In the Kuram Valley the fibre of the leaves is the usual and ordinarily the only source of rope, all imported as leaves from Khost.

Kuram—Is a large village and fortress situated on the left bank of the river of that name, at an altitude of nearly 4,800 feet, in an open valley. The nearest hills to the north being over nine miles off, to the south some low hills descend close into the river, but speaking generally it is situated in an extensive open plain, the broad bed of the river lying to its south. At a distance of about 15 miles running from east to west (slightly south) is the Safed Koh range of hills. The two highest points are at the extreme ends. The one at the east called Karaira is about 15,200 feet, the one at the west called Sika Ram (but by the local natives Spin Ghar) is 15,400. From Kuram, 4,800 feet, to base of the hills to its south, up to 6,000 feet, except for irrigation, which has been most laboriously carried out, the plain country would be an arid shrubless tract perfectly treeless; grasses and a few small herbs alone give the little green that occasionally meets the eye. When

irrigation is employed then the crops are in profusion and rich, the soil yielding two crops in the year; the first, barley, wheat and clover; the second, maize, rice, millets, tobacco, peas, cucurbitaceæ, a little opium, and some cotton in the more southern parts of the district, with numerous orchards of large trees. The greatest extent and finest cultivation occurs at the exit of the various streams from the mountains on to the plains, under the protection of the hills, as, for instance, at Shaluzan, where the trees grow to as great a size of their kind as any in Kashmir, and much more healthy, owing to the dryness of the climate preventing the numerous lichens and fungi affecting the trees. There are *Chunars* (*Platanus orientalis*) with a girth of 14, 16, 18, 25, and one 33 feet. The walnuts are finer than any I have ever seen. Many trees of 9, 11, 12, 13, and one of 17 feet. With rare exceptions, are the trunks ever hollow or unsound. They have neither lichens nor mistletoes infesting them as in Kashmir. The Amlok, *Diospyrus Lotus*, is very numerous, a good tree, its fruit is considered next in value to that of the walnut. Apricots, plums, apples, pears, grapes, *Eleagnus*, a few peaches, quinces, pomegranates and almonds form the mass of orchards. There are no cherries. Mulberries are grown for feeding silkworms with, and as trees are not extremely numerous, but are fine trees. In actual gardening the natives do little. Onions, a large white radish, with numerous cucurbitaceæ, are all they go in for. Cultivated as flowers in gardens, and near holy-places are the red Damascene rose, a white one, and the double yellow Persian rose, an iris, a mallow, *Melia Azedarach*, as also an *Eleagnus* cultivated both for its scented flowers as well as its fruit.

The other cultivated trees are *Populus alba*, *Salix babylonica* and *Celtis australis*, L., besides another poplar, new to me. There is one cypress in the valley of great age; it is on the side of a hill close to Shaluzan, and noticeable at a great distance.

On the plains between the Kuram river and Shaluzan, the little scrub that there is consists of *Daphne*, *Sophora*, *Coton-easter*, some Barberries, a *Buddleia*, numerous *Astragali*, *Labiatae*, *Compositae*, of which species of *Artemisia* are very

numerous; but any or all of them are chiefly found in the more sheltered hollows rather than on the open plain. *Convulvulus lanuginosus* is profuse in small hummocks from the Salt Range to Kuram and Ali Khel. Many species of the numerous *Astragali* found here will prove to be Tibetan in their type.

These plains consist of débris of all shapes and sizes with mould poured down from the adjacent hills by the force of snow and water, deposited in great fan-shaped masses, with a stream belonging to each fan, cutting its way down through its centre and making its way towards the river, usually reaching it with a much diminished supply of water, whether taken from it for irrigation purposes, or absorbed in passing over the loose beds or shingle. In some instances the whole of the water of a stream, especially in summer, is expended long before it has any opportunity of getting to its proper outlet—the River Kuram.

The general outline of the country, and the above peculiar fan-shaped débris deposits, are best noticed at some distance from the south, as in crossing over the Darwaza Gai Pass towards Kuram, from which the view very much resembles that seen of the Ladakh valley on looking southwards from Leh, as long as one can imagine the distant forests to be mere shading of the hills.

In looking over the Kuram Valley and the hills beyond from the Darwaza Gai Pass, we see lying before us (usually) the great mass of the snow-clad peaks of the Safed Koh range, extending from north-east to south-west. The lower hills, or rather high peaks of the spurs of the main range, seem to form two or three lower ranges, these are all covered with forest from the top down to 7,000 feet, after which they are seen to be bare as they gradually lose themselves in the plains that extend from 9 to 15 miles before it reaches the river.

The first vegetation to be traced on these hills on their southern exposure is *Quercus Ilex*, commencing at about 7,000 feet, as a good large dense bush; this as it ascends gets more tree-like and begins to be mixed with Deodar, *Pinus excelsa*, *Abies Smithiana* gradually forming a dense forest, when *Abies*

Webbiana appears in it, chiefly near the ridges, and continues up to 11,000 feet, when the forests thin off, and gradually cease. At 9,000 feet, commonly *Quercus semecarpifolia* appears and takes the place of *Quercus Ilex*, if it has come up as far, or often drives out the pines and forms a forest of its own.

East of Shaluzan with a south exposure there is no *Juniperus excelsa* or *Pinus Gerardiana*, and as far as I can hear, and of what I myself have seen, there is no *Pinus longifolia* from Thull to this. *Pinus excelsa* in this district taking to itself the Pashtu term "Nakhtar." Except the bushes being larger of the already specified *Daphne*, *Sophora*, *Cotoneaster*, Barberries with an occasional *Viburnum* and honeysuckle, there is no undergrowth or bush vegetation. In this locality these forests of Deodar are very fine, and the timber superb. It forms fully three-fourths of the forest usually. Except of *Quercus semecarpifolia* in certain localities, the timber of the other trees is in too small a quantity to be alluded to when so much Deodar is forthcoming. It is curious to note how the forest of Pines is directly got at through the *Quercus Ilex* scrub, there being no intervening forest as in the Himalayan ranges. As already stated, these forests reach up to 11,000 feet, here they become less dense and a few shrubs of *Rhododendron anthopogon*, the gooseberry and currant with bush juniper (not *excelsa*) and some willows and *Loniceras* fill up the vacant spaces in the ending forest, until the bush juniper alone with *Betula Bhojpattra* (in one locality) alone remain to be superseded by Rhubarb, *Eremuri*, *Fritillaria*, some grasses, *Carexes* and *Cruciferae*. Vegetation here is not stopped by perpetual snow, as on the southern exposure of this range, there was no snow during the winter of 1878-79. But it is kept down, I should say, in its altitude by want of moisture in the soil as well as air. If snow existed all the year round vegetation would naturally ascend, I believe, higher than it now does.

From Thull to Shaluzan and up the southern face of these hills I have seen but one fern, viz: *Adiantum Capillus-Veneris*.

Heretofore I have gone over the vegetation as presented to us upon the southern aspect of these hills. Let us go along a water-course, or stream bed, and examine any other exposures

of these hills than the south. We find in the first place the pines descending to form a natural forest much lower down, a deodar and *Pinus excelsa* may be seen at 6,500 feet. The forests thin with a great deal of shrub and underwood, and shrubs gradually being removed by other trees than pines. At first it is enlarged bushes of the original *Daphne*, *Sophora*, *Cotoneaster*, Barberries, then *Fothergilla involucrata* (a Kashmir type), *Cotoneaster bacillaris*, several roses, *Buddleia* in profusion, several large Astragaloid *Leguminosæ*, another large Barberry, two Jasmines, several *Loniceras*, Pomegranate (wild), all mixing with *Quercus Ilex* as a dense bush, sometimes a tree and a profusion of grasses.

In the "Shud Tor" ravine with entirely precipitous sides and narrow, we come upon the walnut as a forest tree quite wild, proved by the fruit, and perfectly natural, two species of *Euonymus*, *Viburnum*, *Carpinus*, *Prunus Padus*, *Sterculia*, various *Lonicera*, *Rhamnus*, and in the moisture of this valley *Taxus baccata*, this being its western limit, it occurs in all the valleys to the east in similar positions. At from 8,000 to 9,000 feet a *Rhododendron* near *lepidotum* of Wallich with green flowers. Besides a *Lycopodium*, eleven species of ferns, *Podophyllum*, and quantities of *Hedera Helix*. Neither *Juniperus excelsa* nor *Pinus Gerardiana* exist here.

The Peiwar Kotal range is a spur from Sika Ram (Spin Ghar) extending south-west until it gradually loses itself in numerous small spurs at the Kuram river, round which the Kuram river bends from a southerly to a south-east direction. The range of hills at the Peiwar Kotal have an altitude of from 8,400 to over 9,000 feet, with a precipitous descent of nearly 1,000 feet to the east. At the base of the Kotal in the valley leading up to it by the village of Turai, except when cultivated, the ground is covered with a more or less dense jungle of *Quercus ilex* (covered with two species of mistletoe), but mixed here as we notice for the first time as a shrub soon becoming a tree *Juniperus excelsa*, and our old friends the *Daphne*, *Cotoneaster* and *Sophora*, besides more numerous the small yellow rose, and *Buddleia*. As the ascent up the precipitous face of the Kotal takes place, Deodar becomes numerous with the oak

as a tree and *Abies Smithiana* and *Pinus excelsa* now forming a tolerable forest. Here an ash, *Fraxinus Moorcroftiana*, Wall., is not uncommon, and *Juniperus excelsa* as a tree numerous. But not until we get fairly on and into the woods of the Kotal do we come upon *Abies Webbiana*. Except the two oaks, *Quercus Ilex* and *semecarpifolia*, there is no undergrowth whatsoever. *Taxus baccata* does not exist in the forest, nor do we come upon Gerard's pine until we pass through the forests of Kotal and come upon their north exposure, where, on the lower edge of the forest, it is common.

The Deodar forest from the Spin Ghar Kotal to the Peiwar Kotal and for miles to the south upon this spur of hills is simply superb, and almost unlimited in extent, and capable of being easily worked. The other pines are proportionately few, but help to form a very dense forest.

The Hariab district is the basin of the Hariab river, that is formed by the south-western base of Sika Ram (Spin Ghar), and its two spurs, the Peiwar Kotal range running southwards and the range that ends in Mount Matungé running nearly west. The Hariab falls into the Hazar Darakht river at Ali Khel. The Hazar Darakht river forms the base to the triangle, with the two ranges of hills already spoken of, and thus completes the boundaries of the Hariab district. The Hariab river takes its rise from the several streams that rise from the south-west face of Mount Sika Ram (Spin Ghar); it is supplied by tributaries from the hills to its north and south until it reaches Ali Khel, where only the streams from the south and east of Mount Matungé fall into it as it itself joins the Hazar Darakht, a much larger stream. This united stream subsequently flows into the Kuram. At Zabr-Dast Killa the river may be called Hariab, as here at about 8,200 feet, the river is joined by several streams of one size.

On its southern or left bank until the river reaches Ali Khel there is little or no cultivation, as the hills come down to the banks of the river. On the right bank there is a great deal of cultivation, as there is a large amount of good land on this side in plateaux, all of which is fairly cultivated from the base of Sika Ram to Ali Khel. The land produces but one

crop during the year—wheat, barley, maize, rice, millets, pulses and clover. Tobacco is occasionally grown and several of the cucurbitaceæ; no vegetables, opium, or oil-seeds.

The climate is much colder and drier than that of Kuram, with a more rigorous winter. The plane tree, *Diospyros*, and vine do not grow here. The walnut as a good-sized tree bearing fruit is rare; small trees are not uncommon. In the stream bed *Salix babylonica* is a large tree, which, with a naturally wild *Salix*, are both cultivated to protect embankments for irrigation purposes. *Hippophaë* is cultivated as a hedge, and along with it an *Elæagnus* is common. The chief sources of fruit are apricots, plums, and apples, and a few pears. The jungle scrub of the hills is chiefly *Juniperus excelsa*, with a very characteristic small stiff spinous grey *Prunus* very handsome when in full bloom with its peach-like blossom. *Daphne*, *Sophora*, two species of *Cotoneaster*, honeysuckle, *Viburnum*, the single yellow rose, and another, with *Cratægus*. In addition to these, as we get somewhat into the forest, currants, gooseberry, a species of *Colutea*, and a very handsome laburnum-like *Astragalus* called "jirrél": the bark of this, cut off in rings, is employed in lieu of brass rings to the sheaths of Afghan knives, and not the bark of *Betula Bhojpattrā*, the paper birch, also a most superb, great scandent honeysuckle, rose-red colour, very fine, and I think a new plant. These forests would grow down to the stream, but they have been driven back by cultivation and search for firewood.

On the southern exposure of the Peiwar Kotal range from two miles to the east of Zabr-Dast Killa and in all forests lying to the west of Sergul is *Pinus Gerardiana*. The Deodar and *Juniperus excelsa* form the forest from this to Ali Khel. *Pinus excelsa*, *Abies Smithiana* and *Webbiana* are driven out into the higher forests and ridges. *Abies Smithiana* and *Pinus excelsa* one can always detect by their cones in the streams, as occurring somewhere above. *Abies Webbiana* has to be gone and looked for. No *Taxus baccata*, *Rhododendron*, or *Betula Bhojpattrā* exist to the west of Sika Ram, at least in the Hariab district.

The fern that is occasionally to be met with is *Asplenium Ruta-muraria*, but I have found five others: *Adiantum Capillus-Veneris* and *Ceterach officinarum*—both only near Ali Khel; *Asplenium Trichomanes*; *Asplenium septentrionale*, and another *Asplenium*—only in one locality each.

The forests here extend up to 11,000 feet, but higher on the northern side: the hills are not so precipitous, and there is more moisture.

In a practical point of view the great value to be attached to a botanical examination of the Kuram and Hariab valleys is its vegetable products, and the value they may possess for any export trade.

The first of these is timber. The Deodar, our finest Indian Himalayan timber tree, forms dense forests, many of which, it will be found, can be easily worked. There is at present no limit to the amount and quality of this timber that can be obtained: means of exportation and forest conservancy are the subjects that now require to be studied. Deodar timber used to be exported from near the Kuram river in Mongul territory by floating down the Kuram *via* Thull to near Bannú. But this has for some years been given up.

In grain these valleys have heretofore had no export trade, producing no more grain than was absolutely required for local consumption. I may say the same of their fruits, except perhaps walnuts and amlok (*Diospyros*). The cause of this is simply *oppression*. There is land enough to double or treble the produce. With a very little more than ordinary care of the water as it is expended, one-third more ground could be brought into cultivation; by appliances of a cheap nature, as wooden troughs, one-third more; and more expensive plant would enable it to be doubled. The very first effects of our rule in this valley will show itself even this season in there being grain enough for our troops locally produced, and next year exportation will begin to take place towards the Punjab for exchange for cotton goods, which are at present expensive.

I cannot come to any opinion as to whether the nuts of Gerard's pine were exported as a real trade article from the Hariab. I know that it is so from Khost.

The natives use no oil; splinters of the roots of Gerard's pine or of the stems of *Pinus excelsa* being used in place of lights.

A crude tar is made from the roots of the above pines for local use. This is their nearest approach to oil. It is employed for local application to wounds and sores.

A little silk is produced at Shaluzan and some other villages; but in this there is no trade.

Probably the substance in which most trade is done both on a large scale and barter is honey. This is extensively exported by through-carriers to Kabul and the Khost country. Nearly every house in a village has its bees from Kuram to Ali Khel.

In a scientific point of view the great value of a thorough and careful research in the vegetation of this altogether new to science district is the material assistance it will give to the better knowledge of the geographical distribution of plants, and the meeting of the several Floras of Europe, Persia, Afghanistan, Tibetan, Himalayan and Punjab tropical, which I already see radiate round the Safed Koh range as a focus, besides enabling one to obtain a more detailed and extensive knowledge of the peculiarities in the distribution of plants dependent on climatic zones, more or less influenced by a moist or dry atmosphere.

From the 600 species I have already collected I can see already the immense value likely to accrue to scientific botanists by the collections I am now making, and consider that the Government should permit of the subject being thoroughly worked out.

The Carob Tree in India.

TO THE EDITOR OF THE "INDIAN FORESTER."

SIR,—In a note on the Carob tree, *Prosopis dulcis* (*Ceratonia siliqua*) at pages 39-40 of the July number of the INDIAN FORESTER, it is stated that the pods of this tree at Lahore were inferior to those of Lucknow. This is a mistake; the pods sent by me to Mr. Duthie, Superintendent, Saharanpore Botanical Gardens, was reported by that gentleman as *superior* to the Lucknow ones.

This leads me to remark that the probable reason why the Indian pods are inferior generally to the European ones is, that in India they ripen far too rapidly. The pods I sent to Mr. Duthie were grown in my own garden at Lahore. This garden is on the old Sailaba soil, close to where once the River Ravi flowed. The soil is productive, and the tree was sheltered by abundant foliage on all sides, and had water in sufficient quantity. But even here I noticed that the abundant clusters of pods developed well all through the cool (or rather the genial) spring, but as soon as the heat of May set in, the ripening process seemed to go on too rapidly, the pods exhibited black patches, and then soon turned black altogether;—by the first week of June they were fully ripe. In other words, the flowers being formed in the winter (about December) the whole process of development and ripening was completed in about six months, the last month or so being a very forcing climate.

Now in Europe, the trees flower in autumn, and the pods are not ripe till the end of the following summer, taking 10 or 12 months, (and that in a less forcing climate) to accomplish what in India is done in six months.

In Lucknow the hot weather comes on earlier, and hence the forcing process is exaggerated. I noticed that as long as the pods were green, they were intensely astringent to the taste, but as they ripened, this astringency was reduced, and the pods acquired a decided sweet taste. In the Agri-Horticultural Society's Gardens, the numerous trees (probably for 20 to 30

in number) seeded also. The tree has been largely grown on the Shahpur district, but is not much valued; as the tree is *diœious*, it is necessary to be careful to have the trees of both 'sexes.'

It has been said that perhaps the tree would be improved by grafting, but on writing to correspondents in the Riviera, where the Carob is grown by thousands, it was ascertained by my friend, Mr. F. D'A. Vincent, that grafting is not necessary and is never practised.

Nor is it easy to see how grafting would overcome the difficulty of the too rapid ripening and the forcing climate. This will possibly be overcome by gradual acclimatization and by the trees becoming *accustomed* to the temperature. We have resolved to continue the experiment by getting European seed from France, the Riviera, Cyprus, &c., and comparing the results with those obtained from acclimatized seed.

In conclusion, I should mention that my garden in which the best Lahore specimens grew is singularly fertile. I have, growing in it, magnificent species of the *Bombax malabaricum* (producing plenty of that curious substance "Mochras"), also the *Mimusops*, *Acacia stipulata* and *Acer oblongum*. In it also *Lagerstrœmia reginæ* flowers and fruits, being, I believe, the most northern locality in which this is the case. *Pinus longifolia* grows well, as also *Gmelina arborea*, which fruited this year in May in great abundance. I have the *Ficus elastica* flourishing, and most *Eucalypti* succeed (of course excepting the temperate species, *Globulus*, *Stuartiana*, &c.)

Yours truly,

B. H. BADEN-POWELL,
Conservator of Forests, Punjab.

We have received a circular giving some details on the results of the attempt to grow the Carob tree in the Punjab, which will be interesting in connection with a letter which we publish above. Mr. Baden Powell writes thus:—

Speaking generally of the growth of the Carob tree, it may be safely said that *there is no difficulty whatever in raising the Carob tree in the Punjab*. There are trees in almost every

station garden in the province. But the tree being *diacious*, it is necessary to have several trees in order that there may be fruit. The seed germinates well; and though the tree likes plenty of water, there is no difficulty in raising it with but little water. It dreads severe frost and saline soil—that is all. It has, I believe, been most largely planted in the Shahpur district. At Lahore there are numerous trees; and I have in my own garden one about ten or twelve years old, laden with fruit.

The only question is, will it ever be popular with the Natives, and become useful? Will they plant it about their wells and on hedgerows between the fields? My own fear is that they do not care for it.

The pods are altogether inferior to the European. I have been watching mine, and I find that, while they are green, they are intensely astringent, and that now (end of May) they seem to be ripening rather by a sort of fitful drying up process than of a gradual mellowing and ripening all over. The green pods begin to exhibit brown patches where the seeds lie, then to turn brown at the tip; finally to curl up and dry. Whether it is that our heat of May and June is too great, I cannot tell. Although my tree is in excellent soil and constantly watered, the pods are thin and the seeds not half the size of the pods one sees in Europe. They are slightly sweet when ripe, and have lost in that state most of the astringent flavour.

It is my intention, besides persevering with the Carob plot and gradually introducing more and more plants into the small area available, to sow a few acres in the Kot Lakhpat rakh. This rakh is in the vicinity of Lahore, and is constantly supervised, as it is being sown with jand and kikar for the purposes of general improvement of its growth (as a fuel reserve).

Thus it will be seen that the growth of the tree itself offers no difficulty whatever. The principal object now to be borne in mind is to ascertain whether grafting is necessary, or whether the fruit can be improved by manure and free watering.

If either of these is the case, though it will, I fear, prove a serious bar to the tree becoming *popular* or generally grown, still it is a difficulty that can be overcome.

If, on the other hand, it is not the case, and it is the climate that is in fault, then the experiment must be considered a failure, unless by acclimatising we can gradually change the character of the tree.

Meanwhile a quantity of good European seed has been written for to continue the cultivation; and I will also make enquiries about grafting. If possible, I will get some good trees out from which to graft. We shall then have all the following conditions under trial: (1) trees grown from acclimatised seed; (2) ditto grafted; (3) trees grown from fresh imported seed; (4) ditto grafted. The results of all these will have to be compared, and ought to settle the question in due time.

In conclusion, I beg to say that I have sent to Mr. Duthie at Saharanpur a bag containing some of the ripe fruit pods that I have gathered. They are small both as to the pod and seed—much smaller and thinner than those seen for sale in England in shops.

I may add that I have never tried manuring and pruning the trees; but even should we thus succeed in improving the crop, it would be a heavy drawback to the popularity of the tree as a kind to be commonly grown by the peasantry.

I have learnt from Europe (through Mr. Vincent) that the tree is *never* grafted. It, however, takes ten to twelve months to mature its large sweet pods. In the Punjab the tree flowers in December, and the pods are in this rapid climate hurriedly ripened (see paragraph 7) in *six months*, by the first week in June. We may be able to accustom the plant to the climate, so that it is worth while persevering.

So that, on the whole, the prospects of acclimatizing the tree not seem very hopeful.

The 'Hazara Forest Regulation' of 1879.

PUBLICATION has lately been made of the new 'Hazara Forest Regulation of 1879,' which deserves notice from the much more definite rules for forest management than were given in the old rules of 1873. The rules are divided into five Chapters, *viz.*, (I.) Preliminary; (II.) Reserved Forests; (III.) Village Forests; (IV.) General; and (V.) Liabilities, Offences and Penalties. These new rules came into force on the 1st August last, and were applied to the Hazara District, excepting the territory of the Nawab of Amb, and any ilakas and villages which might be especially exempted by the Punjab Government. The 'Reserved Forests' had probably all been formerly constituted, so the rather cumbrous process of reservation required by Chapter II. of the Indian Forest Act could be avoided; and the rules regarding them are very simple. The 'Village Forests' occupy a very prominent place in the new regulation. They are to be lands set apart by the Deputy Commissioner of Hazara under control of Government, and are to include the crests and slopes immediately below the crests of hills, the catchment basins of rivers, the banks of such rivers, all steep and rocky slopes, and such other waste lands as the Deputy Commissioner may consider advisable for the supply of material or otherwise. These forests are to be managed under 'General Management Orders,' which are to be issued from time to time by the Deputy Commissioner under the General Orders of Government, and are to provide chiefly:—1st, the number of trees or the area to be cut during the year; 2nd, the thinnings and other works of improvement for each year; 3rd, the localities of grazing or cutting off grass; 4th, the kinds of trees that may be lopped for fodder; and, 5th, the places where 'Surkhi' or charcoal may be burnt. The 'General' chapter provides in section 18 for the prohibition to fell plane trees or other kinds growing in groves, near villages, along roads at burying places or 'ziarats,' or near springs and streams. It then goes on to regulate the seigniorage dues to be paid to those entitled to receive them from Government on account of fellings in the reserved forests, according to the rates in force. Also it provides for making the owners of cultivated lands or steep hill sides protect

it by a retaining wall or other precaution to ensure the stability of the soil. Provision is also made for enclosing and planting any places which may be in danger from landslips, and treating such lands as if they were a 'Reserved Forest.'

The Chapter on Penalties contains much the same provisions as the Forest Act of 1878. Section 24 makes land owners, users of rights in the forests, contractors and their employes bound to aid in the prevention and prosecution of offences and in the extinguishing of fires. Section 28 makes villagers, landowners, and others in the vicinity of the forest jointly and severally liable to punishment in the event of illicit burning of the forests or neglect to render assistance in preventing a forest offence. Section 29 gives the Deputy Commissioner authority to close lands which have been burnt over for two years or longer, if such longer time is necessary to repair the damage done, from all rights of user, and provides for the payment of the expenses of protection, and cost of reproduction being recovered from the persons whose negligence contributed to the burning. In section 31 provision is made for impounding cattle seized in the forest, provided they are not in a road along which right of way exists, or near the boundary of a forest adjoining cultivation where the forest boundary has not been fenced. In this respect the Regulation comes very close to the Indian Forest Act, though the provisions are somewhat more strict, but the whole of the rules have evidently been drawn up with great care, are concise and easy to understand, and in some respects contrast favorably with our much more complicated Act. But their application and the results of writing under them depend very much upon the individual Deputy Commissioner. If that officer is interested in forest work, and anxious to preserve the forests and prevent denudation, these rules are everything that could be desired; but if not, it seems likely that their provisions, stringent as they are, are little likely to be regularly carried out, and the 'General Management Orders' and plan of operations will be little attended to.

The "Nanmu" Wood of China.

MR. GEORGE TAKEDA, of Tokio, Japan, has kindly sent me a piece of the famous *Nanmu* wood, of which the expensive coffins used in China for persons of wealth and quality are made.

The wood is soft to moderately hard, even-grained, with a pleasant aromatic scent when fresh cut. It is of a dark olive brown colour, shining with a beautiful lustre, and its weight is 34 to 35 lbs. per cubic foot. The structure agrees with that of most woods of the family of "Laurels" to which the tree belongs. It has small to moderate-sized pores, uniformly distributed, often subdivided, distinctly visible on a longitudinal section. The medullary rays are fine, uniform, and equidistant, and the annual rings marked by a band of darker coloured autumn wood.

Specimens of the tree have lately been received at Kew from China, and the following is an extract of a letter received from Professor Dyer, the Assistant Director, dated the 7th July, regarding this remarkable tree :—

"You will be interested to hear that we have obtained, by the kind offices of Père Vincot of Tchong-king in the province of Szechuen, flowering specimens of the *Nanmu* tree. They vindicate Professor Oliver's determination from the leaves which were all that we had previously, in a very interesting manner. The species is closely allied to *Phoebe pallida*, and *P. lanceolata*, but is, as Professor Oliver believes, distinct. He will figure and describe it in the "Icones Plantarum" as *Persea Nanmu*, Oliver. Mr. Benthams, in his recent revision of *Lauraceae*, places *Phoebe* under *Persea*."

D. BRANDIS.

Experience in the germination of Acorns in the Nurseries
of the Darjeeling Division, during 1879. By J. G.
McDonell, Deputy Conservator of Forests.

THE following notes refer chiefly to the acorns of the 'big oak,' or 'Booke' (*Quercus lamellosa*) and of the 'Phalat oak' (*Q. annulata*); seeds of another species (*Q. pachyphylla*), which grows to a very large size, and has a very valuable timber, were also collected, but were mostly found to be bad.

The Darjeeling Division, as now constituted, contains three Ranges, each on a spur of the Senohul mountain, which forms the central point of the mountain-system of the district. Towards the plains runs southward the Mahalderam spur, the forests of which, at an elevation of 5,500 to 8,500 feet, form the Rangbúl Range; to the north-east runs the Tukdah spur, the forests on which, at a similar elevation, form the Tukdah Range; while the Goompahar range covers the spur of the same name which runs westward to the frontier of Nepal.

The present notes refer principally to the Rangbúl and Dooteria Blocks of the Rangbúl Range, and the chief nurseries mentioned are:—

1st.—The old Rangbúl nursery, elevation, 7,500 feet; soil, a rather stiff yellow clay.

2nd.—The Dooteria nursery No. 1, elevation, 7,300 feet; soil clay, not quite so stiff as in Rangbúl, and with a larger proportion of vegetable mould.

The seed required for sowing in 1878-79 was collected during the winter of that year: only perfectly sound seeds were accepted, all seed perforated by insects, or small in size, being carefully picked out; it was collected at contract rates of Re. 1 per maund, cleaned, *i.e.*, the husk was taken off, and it was ascertained that about 3,400 seeds went to the maund. It should be noticed that the acorns of these Sikkim oaks are very much larger than those of the oaks of Europe or of the N.-W. Himalaya.

The seed was taken to the Rangbúl Forest House, and *at first* the greatest pains were taken to dry it in the sun, so as to avoid damp, but in a very short time it was noticed that worms were appearing among the acorns. On careful examination these were found to come from the inside of the seed; apparently the egg having been laid by the insect when the seed was young and soft. The worm (a small white grub) makes its way out of the seed in due time.

At first it was thought that all worm-eaten seed was bad, and much was thrown away in consequence, until some were found, in a heap of those so thrown away, which had germinated despite the boring, and it is now quite certain that as long as the germ is untouched, the seed is none the worse.

Much doubt existed as to the proper time at which to sow it, and it is not yet quite certain whether it is best to sow at once or keep the seed till the rains; the nurseries at Rangbúl were sown very soon after collection of the seed, *viz.*, in January, and have not succeeded very well; one nursery in Dooteria was sown in May, and the success is quite equal to that of Rangbúl, but again the seed sown in the latter was such as had been dried in the sun, whereas that used in Dooteria had never seen the sun after collection, but was kept in a dark and dampish godown at Jore Bungalow.

One thing is quite certain, that among the seed dried so carefully at Rangbúl, there was a much greater proportion of worm-eaten seed, and also of seed that had completely dried up and become black inside.

The opinion I have arrived at is :—

(a.) Seed should be collected as soon as ripe and sown at once.

(b.) A reserve should be kept for filling blanks, &c., in the rains, and of this I would keep a certain portion with the husk or cup on, the whole to be stored in a godown, away from any dry heat.

Oak seed apparently takes from one month to nine months to germinate; in Rangbúl where the beds were watered during February and March, the seed sown in January was still coming up in September; in Dooteria seed sown in May began

to germinate in fifteen days, and was going on in September also; the latter, as observed above, had been kept in a damp godown.

The following statistics of seven beds in No. 1 Nursery, Dootaria, will show that seed need never be despaired of under nine months.

This nursery was sown on the 15th January, an inch or so of earth more or less being put over the seed; they did not begin to germinate till May, and on the 31st May, when the nursery was visited by the Inspector-General, there were not 100 seedlings in the seven beds mentioned; the following table will show the results of different countings at various dates carefully made by me in person :—

Nos.	9th June	21st July.	7th Augt.	15th Augt.	15th Sept.	1st Oct.
1	Nil.	60	130	162	297	207
2	26	80	135	139	163	163
3	15	47	80	92	109	110
4	9	103	182	192	217	224
5	41	121	188	195	230	237
6	9	71	116	133	197	189
7	32	66	110	112	117	116
	132	547	941	1,025	1,212	1,246

The most remarkable is probably bed No. 1, which, sown 15th January, had not one seedling in it on the 9th June, and yet six weeks afterwards had 60 seedlings above ground, and two months later 197 seedlings. It will be readily imagined how often I was informed that since nothing had come up in six months the seed had rotted in the ground, &c.

In another nursery a curious thing happened. This nursery (in Dootaria) was sown in May, and at the time of sowing all worm-eaten seed was carefully picked out and thrown away in a heap round an old tree stump. On the 8th July I visited the nursery, and noticing a healthy seedling struggling up through the grass, looked further and unearthed the heap of "bad" seed. Out of this heap I then got over 100 seedlings, and have procured more since then. Following out the idea here presented, I took what

NURSERIES OF THE DARJEELING DIVISION, DURING 1879. 199

seed I had left in the godown, spread it out on the earth and covered it over with three or four inches of soil ; this was in July, and now I gather a crop of seedlings from the seed bed, about once a month, and fill empty beds in nurseries.

As an experiment some beds were sown with seed in the husk or cup, but it appeared to retard the germination, if anything ; at any rate, I could see very little advantage to be gained from this mode of sowing, except, perhaps, that it was somewhat of a protection against squirrels, which do a great deal of damage to nurseries sown with oak ; apparently they think the seed is put there to supply them with food during the rains, and in one or two nurseries made near a forest, hardly a seed was left in the beds.

I think it would be an advantage to keep some seed in the husk as mentioned before ; those so kept this year never got dry like those cleared, but it is not indispensable I should say.

II. OFFICIAL PAPERS.

Memorandum on the scale of Forest Maps in the Madras Presidency, by D. Brandis, Inspector-General of Forests, dated the 1st March 1879.

I UNDERSTAND that the preparation of forest maps is under consideration in the Madras Presidency, and that it has been proposed to have two classes of maps on different scales for each forest, *viz.*, one on the scale of one inch to the mile for general reference, and one on the scale of four inches to the mile for full details.

2. In many cases, this will doubtless be a convenient arrangement, but I would beg strongly to urge that no hard and fast rule be laid down regarding the scale of forest maps, as this must in each case be regulated by the character of the forest and by other circumstances. I may, perhaps, be permitted to illustrate my meaning by a reference to the maps of certain forest districts, which I have lately had the privilege of examining.

3. For some of the hill forests which are attached to the Forest School Circle of the North-Western Provinces, maps on the scale of four inches to the mile have been prepared, and I have lately satisfied myself in examining some of these forests by compartments with the map in hand; that in these forests it would be impracticable to work with maps on a smaller scale. These forests are used to provide for the requirements of railways in the matter of sleepers, and of the military station of Chakrata in the matter of fuel, charcoal, and timber. They must be managed in detail, the treatment of each compartment varying according to soil, aspect, and steepness of the slope, and the character of the growing stock.

4. These forests I examined in November and in December. I spent some time in the inspection of the reserves formed a few years ago in Ajmere and Mhairwarra. In these forests

protection is now the main work, and must be so for many years to come; and, consequently, maps on a smaller scale are sufficient for all present requirements. They are on the scale of one inch to the mile, and these maps I found amply sufficient for all present purposes, although these forests are situated on broken hilly ground.

5. Again, a short time ago, I examined the Sidli Forest in the Goalpara District of Assam, the map of which is also on the scale of one inch to the mile. This forest is on level ground, but it is traversed by numerous streams, and it presents a considerable variety of vegetation, sal forest alternating with extensive grass lands and belts of evergreen forests which skirts the streams. It has been divided into blocks and compartments, and the map, which shows both the configuration of the ground and the character of the vegetation as far as it depends upon the character and level of the soil, is on a sufficiently large scale to serve as a guide for the protection and working of the forest.

6. On the other hand, forests which require extensive working, such as large plantations, will be found to require a scale larger than four inches to the mile.

7. What I wish to submit is that it should not be considered essential to have a map on the scale of four inches to the mile for all forests. I understand that of some waste tracts in the Madras Presidency topographical maps are prepared on scales less than four inches to the mile, and I would suggest that in many cases a smaller scale than four inches to the mile will be found to suffice for forest maps, and that in such cases there is no immediate necessity for a special survey. In all cases existing maps should be made to answer for as long a time as possible. Where no maps exists and a special survey must be made, its scale should depend on the nature of the work to be done in the forest, and where the treatment for many years can only be protective, a map on two inches or one inch to the mile will probably be found to answer all requirements. If, however, extensive working is likely to be undertaken within a few years, it may be better to survey at once on the larger scale of four inches to the mile.

8. I would also beg to mention that it is not necessary, and, as a rule, not desirable, that the printed maps should contain details of a temporary character, such as the description and age of the growing stock, the areas of plantings and fellings, and the like. This information can be added by hand on printed copies of the maps, which can be corrected and added to from time to time. Where the character of the forest growth is determined by the nature of the soil, as is the case in forests of sal, khair, and sissoo, it will be useful to exhibit the limits of such forest growth in the printed maps, but the general rule should be that printed maps should contain only such detail as is of a more or less permanent character.

9. It would be better to use separate copies of the maps to show the geological formation of the ground, the nature of the crop of trees, and such other different circumstances regarding the forests.

10. On the other hand, what is specially required in the case of forest maps is great care in entering the names of streams and other localities correctly, as they are known and used by the people of the country.

Development of the Silk Industry.

Extract from the Proceedings of the Chief Commissioner of Assam, in the Revenue Department, dated Shillong, the 6th June 1879.

THE attention of the Government of India has long been directed to the possibility of developing the silk industry of this country, and at various times information on the subject has been collected.

For a long time, under the management of the East India Company, efforts were made to develop this industry by encouraging the cultivation in this country of the silkworms commonly cultivated in Europe. These experiments were carried on with varying success, but little or no permanent results were obtained.

8. I would also beg to mention that it is not necessary, and, as a rule, not desirable, that the printed maps should contain details of a temporary character, such as the description and age of the growing stock, the areas of plantings and fellings, and the like. This information can be added by hand on printed copies of the maps, which can be corrected and added to from time to time. Where the character of the forest growth is determined by the nature of the soil, as is the case in forests of sal, khair, and sissoo, it will be useful to exhibit the limits of such forest growth in the printed maps, but the general rule should be that printed maps should contain only such detail as is of a more or less permanent character.

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Extract from the Proceedings of the Chief Commissioner of Assam, in the Revenue Department, dated Shillong, the 6th June 1879.

THE attention of the Government of India has long been directed to the possibility of developing the silk industry of this country, and at various times information on the subject has been collected.

For a long time, under the management of the East India Company, efforts were made to develop this industry by encouraging the cultivation in this country of the silkworms commonly cultivated in Europe. These experiments were carried on with varying success, but little or no permanent results were obtained.

The results of the more important recent inquiries which have been made by the Government of India are embodied in a work entitled "Silk in India," by J. Geoghegan, a work containing much useful and interesting information on this subject.

Printed at Calcutta
Government Press, 1872.

2. Since the publication of this work, the Government of India called for further information in Resolution No. 5-156-165, of 23rd November 1875. Copies of this Resolution were distributed throughout the Province of Assam, and the information received in reply was embodied in this office No. 256, of 9th February 1877.

Important experiments were at the same time conducted in Europe, which have resulted in proving that the difficulties which have hitherto in this country been found insuperable, in the matter of winding Tasar cocoons and dyeing this silk, so as to equal the results obtainable from the ordinary staple European silk, have been completely overcome. Experiments have also been made with some of the most common silkworms of Assam, such as the Eria and the Múga, and results but little less satisfactory have been obtained.

It seems not improbable, therefore, that the produce of these and other native silkworms of India, will, if it can be supplied in sufficient abundance, obtain as firm a position in the European market as the produce of the common mulberry silkworm (*Bombyx Mori*).

3. The most widely-distributed silkworm in India is the Tasar, and it is to this that attention has hitherto been chiefly drawn. This silkworm, however, though it is found within this Province, is not common. But there are other well-known silkworms which are commonly cultivated in Assam, and whose value will probably prove little, if at all, inferior to the Tasar, and it is in the extended cultivation and production of these that the development of the silk industry of this Province obviously lies.

Besides the two which are abundant in this Province, the Múga and Eria silks, upon which experiments have been successfully tried, there are a large number of wild silks to be

found throughout this Province which have never yet been subjected to experiments under trained European skill. It is very important that a sufficient quantity of the cocoons of these silkworms should be collected and forwarded to Europe for examination. The success which has recently been obtained in the manufacture of Tasar, Eria, and Múga silk renders it not improbable that other common wild silks of this Province will be found to have a value in the European market. It is of great importance that this point should be ascertained, as the cultivation of the silkworms indigenous to this Province will be likely to be accompanied with the least difficulty. It is not to be expected that there will be any extended cultivation of such silkworms before it is ascertained that the produce has a commercial value, and this, therefore, must first be determined. Directions will be issued for the collection of cocoons of the known kinds of silkworm, which have not yet been experimented on in sufficient quantity for this purpose.

4. In consequence of the very important results which have been obtained from the experiments lately conducted in Europe, which seem to point to a possible great development of the silk trade of India, further information has been called for in Government of India Resolution I., of 28th February 1879, published in the Supplement to the *Gazette of India*, dated the 15th March 1879, page 213.

This Resolution, dealing as it does with the silk of India generally, is largely occupied with considerations affecting only the Tasar, and this silkworm, as has been said, is not common in this Province. However it may be in the future, at present it is clear that the attention of those who are desirous of developing the silk industry of Assam should be directed to the cultivation and production of the silkworms common to Assam. It will be sufficient to note here only so much of the Resolution as seems to apply more especially to this Province.

5. At present it would seem that the silk trade, at all events of this Province, should take a new departure; and that, instead of, as formerly, the silk being reeled from the cocoons before sale, the cocoons themselves should be (after the worms have been carefully killed) sorted and packed and sent to market

without any unreasonable delay ; as there is some difficulty in unreeling cocoons if they are more than a year old, and are too hard and dry. This is of the utmost importance, because all the special skill and training, and the great labour which would otherwise be involved in this industry, and which it would be particularly difficult to obtain in this Province, are dispensed with.

It is only now necessary that the cocoon should be produced, and for this purpose all that will be required will be the selection and cultivation of the trees suited to the silkworm, most of which are common jungle trees, and proper care and attention to the silkworm during its growth. This will require little or no capital, and only ordinary skill and attention. In an appendix to this Resolution (Appendix B), such information as is already known on this subject in regard to the cultivation of the more common silkworms of this Province has been collected and is published for general information.

6. The permanent demand for cocoons of the classes common in this Province cannot well be ascertained ; nor can it yet be said whether the production of cocoons will ultimately prove remunerative ; nor can it be said yet which will be economically the most profitable cocoons to cultivate. It will not be till after some time, and after the trade has become to some extent established, that this question can be fully answered. The trade in cocoons, like every other trade, will depend for its success on a great variety of conditions. The cost of producing cocoons in large quantities cannot practically be tested without experiment, and the same must be said of any calculation of their probable market value. The popularity of the material into which they will ultimately be worked, the cost of manufacture, and an immense variety of other considerations must be practically determined before any real answer can be given to this question. But so far as can at present be judged, the prospect of this trade seems eminently hopeful, and there is very much which should direct the attention of the Europeans engaged in tea cultivation in this Province to this industry. As has been said, the difficulties of manufacture have been overcome, and, with the development

of the industry, the cost of manufacture may confidently be expected to decline also; and this will probably result in increased demand for the manufactured articles, and enable a higher price to be paid for the cocoons. Already, one silk manufacturer, M. David, of St. Etienne, has expressed his willingness to purchase 2,000 kilogrammes (55 maunds) of Tasar cocoons at 1 franc per kilogramme for experiment, and there can be no doubt that manufacturers would be found to purchase at a similar price, cocoons of other kinds. This gives a price of altogether 30s. per maund for the cocoons *delivered in France*, which, with exchange at 1s. 6d.=Rs. 20 per maund=8 annas per seer, to cover all cost of culture, collection, and transport. It has been further asserted by M. David and other manufacturers that all the possible production of India would be eagerly bought at this rate. This is probably too low a rate to be remunerative to the producer, but it must not be considered as the final or fixed market rate of the future. The Government of India, in Resolution L. of 28th February 1879, para. 6, assert "there is at least as great a demand in the European markets for the cocoon of the Eria and Muga worm as there is for that of the Tasar." It should be noticed, further, that there is a use for waste and for pierced cocoons, as these, where they cannot be reeled, can be spun.

The great abundance in the jungles of Assam of the food required by the several kinds of silkworm, and the ease with which many of the trees and shrubs requisite for their food can be obtained in the wild state, and could also be cultivated, render possible an almost unbounded development of the production of cocoons. No difficulty need be anticipated as regards carriage of the cocoons, nor need there be any delay likely to cause harm, in transporting them to the manufacturer.

7. A more accurate preliminary forecast of the prospects of the industry could be made, if certain information, which it is hoped to obtain, were available; and for this purpose the Government of India have, in their last-quoted Resolution, directed the following further inquiries to be made:—

* * * * *

"12. The results obtained by Mr. Wardle, as well as by others working independently, are so important, and so full of promise as regards the manufacture of this silk and the utilisation of the manufacture for apparel and other purposes, that it is eminently desirable to thoroughly investigate the question of production. Information on this subject has been sought from various quarters, but the information in the possession of Government is not sufficient to enable it to furnish precise answers. Yet it is necessary, if the attention of capitalists is to be attracted to the development of this industry, that full information should be forthcoming. M. Natalis Rondot, a delegate from the Chamber of Commerce of Lyons to the Paris Exhibition, and President of the Jury in the silk section, has written to the Government of India, asking for information on the following points, not only as regards the Tasar worm, but also as regards other undomesticated worms :—

- (1) An enumeration of the different kinds of wild worms ;
- (2) The districts from which each kind is obtained, and in what quantities ;
- (3) The species of worm from which each kind of silk is manufactured ;
- (4) The trees on which the worms feed ;
- (5) The uses to which the silk is put by the natives ;
- (6) The markets where they are to be purchased ;
- (7) The probable prices of dry cocoons of each kind and of the silk as reeled by the natives ;
- (8) The probable quantities retained for local consumption and available for exportation to European silk mills ; and
- (9) The outturn in money value of the silks woven in India, which M. Rondot thinks must be considerable, especially if Tasar and other similar silks commonly worn by the natives are taken into account.

"13. M. David, of St. Etienne, also asks for information on the following points :—

- (1) The nature of the chemical agent used by natives to soften the cocoon ;
- (2) Whether the natives can reel a cocoon more than a year old ;

- (3) The length of time elapsing from the spinning of the cocoon and the emergence of the moth ;
- (4) Whether the dark and light-coloured cocoons which are found mixed in the bales sent from India are of different varieties, and whether they are found in the same localities ;
- (5) Also, whether it would be possible to obtain bales containing only light-coloured cocoons.

"14. Some information, but of a vague and general kind, exists on a good many of the points enumerated by M. Rondot, and the Governor-General in Council desires that an effort may be made to cause such specific information as is obtainable, with special reference to the quantity obtainable and the prices on the spot, to be furnished with as little delay as possible. It is also much to be desired that particulars of manufacture should be obtained as far as possible."

8. In order to facilitate search for the information which is required, a short *resumé* is given in an Appendix to this Resolution (Appendix A), of what is already known in answer to each of the questions here asked. Directions will be issued for the collection of further information in answer to these questions. The information contained in the Appendix is of a vague and general kind, and is probably not even entirely correct as regards this Province as a whole. It will need verifying in detail as regards each district, and each distinct locality in the Province. In many respects it is also very incomplete. In supplying the information required, it should be understood that what is needed is not wide and general speculations affecting the Province generally, but exact local knowledge, to be obtained by careful inquiry within the district on which report is made.

9. Looking to the great importance to the Province of Assam of the development of a new industry, and the production of a new export staple, the Chief Commissioner is anxious that every effort should be made to develop the silk industry. He therefore solicits the active co-operation of the many European gentlemen resident in this Province. He feels sure that there must be not a few gentlemen whose training and tastes and opportu-

nities must enable them to render very material assistance, both in collecting the information now called for in para. 7 of this Resolution, and in making collections of wild silkworms' cocoons, as is mentioned in para. 3, accompanied with information regarding the natural history of these silkworms, and the price and probable quantity in which they can be obtained at present, either wild or under any system of cultivation.

But, above all, the active co-operation of European gentlemen is needed, if the cultivation of the more commonly-known silkworms of Assam is to be developed, so as to form an important staple of trade. There is much cultivation of silk in Assam, but such as there is, is chiefly in small quantities, and for home use. There does not seem to be any reason why the production of cocoons should not be almost indefinitely extended. The Chief Commissioner will be glad to hear that the subject has engaged the active attention and interest of gentlemen in this Province. Communications conveying any information of interest on the subject should be addressed to the Secretary, and will always receive the Chief Commissioner's attention; and he hopes that, in addition to the replies which will be received from Government officers in answer to the inquiries contained in para. 7, valuable information may be supplied to him by many gentlemen in this Province.

APPENDIX A.

Information at present available on the subjects of inquiry mentioned in paras. 12 and 13 of Resolution of the Government of India quoted in the foregoing Resolution of the Chief Commissioner of Assam, para. 7.

Questions (1) and (2).—The following is a list of the different kinds of silkworms, domesticated and wild, which are said to exist in this Province :—

SILKWORM.		District in which known to exist.	Approximate quantity in which supposed to be obtainable.
Local name or common name.	Scientific name.		
I. Tassar or Kat-kuri.	Antheraea Paphis (probably there are several distinct species of this silkworm)	Upper Assam Cachar (?)	Unknown, said not to be utilised.
II. Moonga or Muga	Antheraea assama ...	Throughout Assam, cultivated in Assam, wild in Cachar.	Not known.
III. Goree or Deo-Mooga.	Bombyx religiosus ...	{ Assam, Sylhet, and Cachar (?)	"
IV. Eria or Arindy.	Attacus Ricini ...	Throughout Assam and Cachar (?)	"
V. Pát Major or Pát Pooloo or Bora Pooloo	Bombyx Textor ...	Assam ...	"
VI. Pát Minor or Pát Choto.	Bombyx Croesi or Fortuatus.	Assam ...	"
VII. }	Attacus Atlas ...	Cachar and Sylhet	"
VIII. }	Attacus Cynthia ...	Assam and Cachar	"
IX. }	Cricula trifenestrata.	Assam ...	" Cocoons are not used for silk.
X. }	Actias Belene ...	Assam and Cachar	"
XI. }	Saturnia pyretorum...	Cachar (?)	"
XII. }	Saturnia Odora, Saturnia sylhetica.	Cachar (?)	"
XIII. }	Loepa sikkimensis ...	Sylhet (?)	"

Of many of these wild silkworms the local name is unknown. Probably, owing to the silkworm being but little noticed, there is no distinctive local name. In such cases, it will not always be easy to ascertain if the silkworms really occur in any district. Specimens of unknown kinds, if obtainable, can, however, be forwarded with such detailed information as is known, which will enable them to be identified. In supplying information, it should be stated exactly under column 3 whether the worm is known to exist in the particular district reported on, and in column 4 should be stated what is the quantity obtainable in the district reported on now, and what it is presumed the quantity might become, if a steady demand existed, in the opinion of

those who have most practical experience. The amount of silk obtainable should be shown as well as the amount of cocoons. Special attention is directed to this point as one of very great importance in regard to the future of the silk trade.

The silk of the Múga worm varies according to the food it lives on, which again varies in different districts. It should therefore be shown in the replies the kind of silk or cocoon obtainable in each district, as well as the quantity of each kind obtainable.

The *Bombyx* (*Antheraea*), local name *Yama-mai*, a native of Japan, is said to be very hardy, and would be likely to do well in India. It is not known to exist in Assam, but inquiry might be made for it.

Question (3).—The species of worm from which each kind of silk is obtainable.

The five kinds of silk common in Assam are :—

- (1.) Medanggori or Mezankuri, the produce of the Múga when fed on the Mezankuri (or Adakuri) tree (*Tetranthera polyantha*).
- (2.) Múga, the produce of the same worm when fed on the Soom tree (*Machilus odoratissima*), the Sualu tree (*Tetranthera monopetala*) and several other species of trees.
- (3.) The Eri, the produce of the Eri or Erendi worm, *Attacus Ricini*, which is only spun and not reeled. This worm is fed on the leaves of the castor-oil plant (*Ricinus communis*) and the Kessera tree (*Heteropanax fragrans*).
- (4.) Pát Minor, a yellow silk, the produce of the worm *Bombyx Crossi*.
- (5.) Pát Major, a white silk, the produce of the worm *Bombyx Textor*.

There may be other kinds of silk made, particularly among hill tribes, and, if so, information on this point would be interesting. For instance, some Cacharis are said to work up the produce of the *Attacus Atlas* into clothing in small quantities for their own use; and enquiries among the hill tribes, Nagas, Gáros, Khasis, Cacharis, Mikirs, Lushais, Manipuris, &c.,

would probably result in very important knowledge on the subject of utilising many comparatively unknown wild silk worms.

Question (4).—Trees on which the worm feeds :—

I.—The Tasar or Katkura silkworm feeds on—

Local Name.				Scientific Name.
Country Almond	...	...	...	Terminalia Catappa.
Assam	...	...	...	„ alata.
Saj	...	...	...	„ tomentosa.
Jamu	...	...	...	Syzygium Jam bolanum.
(Baer) Ber or Bher	...	...	...	Zizyphus Jujuba.
Simul	...	...	...	Bombax malabaricum.
Sal	...	...	...	Shorea robusta.
Teak	...	...	...	Tectona grandis.
Sidah	...	...	...	Lagerstroemia parviflora.

It is of importance to ascertain upon which of the above trees the Tasar thrives best.

II.—The Moonga, or Muga silkworm feeds on—

Local Name.				Scientific Name.
Soom (Assam) Cheng Thesal (Cachar).	...	...	...	Machilus odoratissima.
Sualu	...	...	...	Tetranthera monopetala.
Mezankuri or Adakuri	...	...	...	„ polyantha.
Diglotti	...	...	...	„ glauca.
Pattichunda	...	...	...	Cinnamomum obtusifolium.
Kotolosh	...	...	...	Cylicodaphne nitida.
Bumroti	...	...	...	Symplocos grandiflora.

III.—The Goree or Deomooga (*Bombyx religiosa*) silkworm feeds on—

Local Name.				Scientific Name.
Peepul	...	...	...	Ficus religiosa.
Bot	...	...	...	„ indica.

IV.—The Eri silkworm feeds on—

Eri	...	...	...	Ricinus communis.
Kesseru	...	...	...	Heteropanax fragrans.

(Besides these two, Geoghegan mentions various other plants, but it is doubtful if these have been carefully verified, and they are named here more by way of suggestion than as statements of fact).

Common Ber	...	...	...	Zizyphus Jujuba.
Keora Kaura	...	...	...	Sapium sebiferum.
Gooluncha Phul (Assam)	}	...	...	Jatropha Curcas.
Bherunda (Bengal)				
Bengali Alu.				
Koosrol.				
Hindu grass.				

V.—Pát Minor, Pát Major, Pát Pooloo, or Boro Pooloo (*Bombyx Textor* and *B. Croesi*) feeds on—

Noonee, or the wild mulberry ... *Morus indica*.

VI.—The *Attacus Atlas*.

The following is the list of trees fed on by this worm, given by Mr. Brownlow, of Cachar, in the Journal of the Agri-Horticultural Society :—

“1. Phakeera (*Cinchonaceæ*)—Foliage slightly bitter, stature middling, tolerably abundant.

“2. No native name,—probably a laurel; foliage redolent of prussic acid, fruit like a plum, kernel containing a large portion of oil, resembling that of bitter almonds; stature large, not very common.

“3. Could not find out any native name, but the tree may easily be identified by its resemblance to the China tea plant, and its frequent occurrence as a weed in tea-gardens, where it is often left by the weeders by mistake for tea; stature middling, common in jhum lands, less so in primitive forest.

“4. Nagdana, (*Artemisia sp?*)—An annual, and one of the most common of jhum weeds; it may be known by the satin pile on its leaves, which rubbed in the finger and smelt cause sneezing; they possess a scent similar to lavender. The Cachar name is quite local, and is probably given to it because of its fragrance. The true Nagdana is the *Boswellia thurifera*; this plant is too small in stature to be available as a silk tree, for which in other respects its abundance peculiarly fits it.

“5. Monphul (Cachar name), known in Dacca as the Myna kata, a thorny, rapid-growing fruit tree, not indigenous, but found in great quantities self-sown about the villages; the fruit is somewhat smaller than an apple, but, except in being yellow, has a good deal of resemblance to that fruit; the fruit is cut up by the natives into slices, which are threaded on the string and hung up in their houses to smoke and dry; stature middling.

“6. Balos, a rapid-growing weed which affects new clearances; the deep green of the leaf, with the elongated delicate red leaf stalks enable it to be easily recognised; very common, and of large stature; fed on also by a *A. Canningi*.

"7. Koorkooree, one of the commonest of jhum weeds; it invades and monopolizes large tracts of land; exclusively or very nearly so, grows to a middling stature, and where abundant, shades the ground completely. This tree is one of the most eligible for training the *Atlas* on.

"8. Lutki (*Osbeckia*), the common conspicuous pink-flowering plant; it scarcely grows large enough to train silk on, but the silk off it is very white.

"9. Bon Chelita, so called probably from a resemblance in the grouping of the leaves to the Chelita; a large hardy, rapid-growing tree, sufficiently common for purposes of silk cultivation.

"10. Kadam (*Nauclea*) a common large-leaved rapid-growing tree, especially on new clearings, where it soon, if allowed to grow, overshades the land; well adapted as a nurse for young tea or any delicate plants; the leaves become of great size when the plant is young, especially on rich hill lands; as the tree grows larger, they diminish in size; occurs mostly on hill lands, seldom on alluvial.

"11. Chelita (*Dillenia speciosa*), a large-sized luxuriant tree, partial to alluvial lands, on which it may be found in clumps or groves; grows very well even in badly-drained soil and with water about the roots; owing to the large size of this tree, its growing in clusters, and the large quantity and bushiness of its foliage, it is eminently adapted for training the *Atlas* worm on.

"12. Boidraj (*Cedrela*?) a large-sized and very common tree in old forests. *Atlas* silk of this is very dark. This tree is very common in the Sylhet district, and occurs all the way down to Dacca.

"13. Lood, also a full-sized tree, may be known by its dark green shiny leaves, and its bark, which is thicker than that of probably any other tree; this tree is also fed on by the *A. Canningi*."

VII.—*Attacus Cynthia* feeds on—

Castor-oil plant *Ricinus communis*.

VIII.—*Cricula trifenestrata*—

Cashew nut *Anacardium orientale*.

IX.—*Actias selene*—

Wild cherry, walnut.

*Question (5).—*The uses to which the silk is put by natives :—

From the Moonga are made the following :—

Soorias (dhoties),	Rhiha (scarves).
Meklas (petticoats).	Chhelang (for men's shoulders).
Jootha Borakapor (worn in winter).	Masabris (curtains).

Eria is converted into Borkapor, Mekla, and Rhiha, Goursha.

Pât is utilised in the same way, and is also used for masahris (curtains). This is chiefly used for the clothing of the higher classes.

The remaining silkworms are not known to be largely used, but clothes are made of Atlas and Deo-moonga silk, to a small extent it is believed, by Cacharis and others, and probably by many hill tribes.

Question (6). The markets where they are to be purchased :—

It is not known whether any of these silks are to be had in the local bazars or elsewhere in Assam.

Question (7). The probable prices of dry cocoons of each kind, and of the silk as reeled by the natives :—

The answer to this is unknown. The present prices can be ascertained by local inquiry in bazars and fairs, and the opinion of local traders and producers taken as to the probable result of an extended demand in reducing the price. The information on this point is of too old a date to be of any present value. It is a question of much importance as regards the future of the silk trade in this Province, and very careful inquiry should be made on this point.

Questions (8) and (9). It is difficult to estimate the probable quantity of silk retained for local consumption. This and the next question can only be answered by local experience and observation of the proportion of people who wear silks of different classes. The average value of these, the approximately known population, and the frequency with which the silk cloths have to be renewed are data on which these questions could be roughly answered. The opinion of native traders and others could also be ascertained on this point.

It is not believed that at present there is much silk available

for exportation. The answer to this is easily ascertainable by inquiry in bazars and of local traders.

See para. 18 of Resolution I, dated 28th February, 1879, Government of India, Department of Revenue, Agriculture, and Commerce.

Question (1). The nature of the chemical agent used by the natives to soften the cocoons :—

A ley of potash formed from plantain-leaves, and cowdung and water, are the only chemical agent known to be used by natives to soften the cocoons.

Question (2). Whether natives can reel a cocoon more than a year old is not known :—

This can easily be determined by local inquiry.

Question (3). The length of time elapsing from the spinning of the cocoon and emergence of the moth :—

For convenience, the natural life of the better-known worms is given below in a tabulated form. The specific information required under this head is entered as correctly as it is known in the last column.

As the trade requires that the chrysalis be killed before it emerges as a moth in the case of the cocoons which are intended for commerce, and not to be reserved for breeding (for otherwise the hole cut in the cocoon diminishes its value), this question is of some importance. The facts on this subject should be carefully determined, and the statements here made should be carefully verified :—

Name of silkworm.	Period of life of moth.	Period from laying of eggs to to their being hatched.	Period of life of the worm.	Period from beginning of worm to spin to completion of chrysalis.	From completion of chrysalis to emergence of moth from cocoon.
I. Tassar or Kutkuri	3 or 4 days	9 days ...	36 days..	15 days ...	Not given.
II. Moonga	6 days ...	10 days ...	30 days...	5 or 6 days	10 to 20 days.
III. Eria or Ariadi	Not known exactly.		A complete cycle is made in from 43 days to two months.		
IV. Pât Major (<i>Bombyx Texator</i>) } " Minor (" <i>Craet</i>) }	3 or 4 days	10 months..	30 to 40 days	5 or 6 days	20 to 25 days
<i>Attacus Atlas</i>	No exact details are given.		Eggs lie dormant through cold weather, and 2 or perhaps 3 crops are obtained in the year.		

The Eria sometimes gives as many as seven crops in the year. The Múga gives five crops a year. The Tasar gives, it is believed, two crops a year. Attacus Atlas gives two or perhaps three crops.

Question (5). As the trade is at present, there might perhaps be some difficulty in effectually sorting cocoons, but under a developed system of sericulture there ought to be no difficulty in sorting the cocoons to suit the market. Suggestions might be offered on this point.

2. As regards their treatment, the natural distinction of silkworms is into those which are wholly domesticated and those which are partially domesticated. About the wholly wild silkworms, which are collected from the jungles, such as is the case generally, though not invariably, in India with the Tasar silkworm, little need be said. It may, no doubt,

be possible to give some artificial stimulus to their production, and in a sense they may then be said to be partially cultivated. Also, many of the wild silkworms may be capable of being domesticated. This is a point which can only be determined by experiment. It may be doubtful whether any large trade in wild silkworms be possible in this Province; but, when once the cocoons have been collected, the general remarks which are made below, on the subject of sorting the cocoons and packing and despatching them, will apply to this class equally with the other classes.

3. Of wholly domesticated silkworms, the common kinds in Assam are the Pát Major and Pát Minor, and the Eria or Arendi. Details, as far as they are known, are given in Appendix A (in answer to Questions 4 and 3a) upon the subject of the food of the better-known silkworms and their natural life, and this information need not be repeated in full. Both these kinds of silkworms are fed wholly within doors, the leaves of the trees and plants they feed upon being plucked and brought to them. The Pát (*Bombyx Textor*), which is closely allied to the common mulberry silkworm (*Bombyx Mori*) of Europe, is more delicate, and has to be treated with more care than the Eria. Also, it gives but one crop in the year, while the Eria may give seven crops. The silk of the Pát is, however, the more valuable. Great care has to be taken to keep every thing about the Pát scrupulously clean.

4. A general point to observe in silkworm-rearing is, that silkworms of as nearly as possible the same size and strength only should be allowed to feed together. If this rule be not observed, the stronger silkworms will bully the weaker, and deprive the latter of their food.

5. The chief partially-domesticated silkworms of this Province are the Múga or Moonga, the Tasar or Kutkuri, and the *Attacus Atlas*. The two latter, the tasars and the atlas, are also found in a wholly wild state, and a silkworm, probably the same as the Múga of Assam, is found wholly wild in Cachar. Some of the other wild silkworms of this Province are said to have been partially domesticated. In Assam, the Múga may be said to be wholly domesticated, but in its general treat-

ment corresponds to the *tasar* and *Atlas*, and other wild silkworms which have been at times partially domesticated, and it is convenient therefore to consider the *Múga* as of this partially-domesticated class.

The difference in treatment of this class of silkworms consists in this,—that they are fed out of doors and not kept within houses. The *Múga* eggs are laid on small bundles of grass or straw, half the thickness of a finger, and tied to the trees before they are hatched. The *Múga* worms are reared on the trees, and standing in the open, and not on leaves, collected and given to the worms in houses, as is the case with *Pát* and *Eri*. Great care has to be taken to destroy the ants, which would otherwise kill the silkworm. This is frequently done by putting baits of molasses, fish, or dead toads, at the foot of the tree. But, besides these enemies, the presence of a large collection of silkworms is sure to attract other enemies: crows, wasps, and the ichneumon by day—bats, owls, and rats by night, will, unless guarded against, destroy great numbers of the silkworms.

The silkworms themselves are prevented from leaving the tree by bands of some smooth substance, such as fresh plantain-leaves, over which they cannot crawl. If all the food of the tree has been eaten, they are allowed to descend, and collected and put on another tree. When about to spin, they will descend the trunk until arrested by the plantain-leaves. They are then collected in baskets and over these baskets are suspended branches of dried leaves, up which they crawl and form their cocoons. Many silkworms drop off the trees, and the ground under the trees on which they feed should therefore be kept clear, to enable them to be easily found and replaced on the tree. Continual heavy rain is apt to wash them off the tree, but otherwise they seem to be able to protect themselves from the rain by crawling under the leaves.

6. It remains now only to explain how the cocoons should be dealt with when obtained. The cocoons will be known to be completed by the absence of any sound within. The first care will naturally be to select a sufficient number for breeding purposes. Many of the silkworms die before completing the

spinning of the cocoon. These are, of course, no use for the present purpose. They may be distinguished generally by their being smaller, and in an incomplete condition, and by a hollow sound they yield when gently tapped. About an equal number of males and females are usually selected. The females may generally be distinguished by being larger than the males, and of a more symmetrical shape. The males have the cocoons somewhat irregular in shape, and as if pinched at one end. These are kept together in suitable places until they burst into the moth. The eggs are generally laid in one or two days, after which the moths die.

In the case of the silkworms which have been classed as wholly domesticated, neither in the stage of the moth nor in that of the silkworm is there any tendency to roam. But in the case of the partially-domesticated worm some care has to be taken to provide against this tendency, while, at the same time, the moths must not be frightened by too severe restrictions.

7. A curious fact which has been noted in regard to these partially-domesticated moths is that it frequently happens that if a female moth be fastened out at a convenient place at night a wild male moth will discover and impregnate the former. This fact is sometimes made use of to strengthen the breed of comparatively wild silkworms, which seem often to deteriorate under domestication.

A further point may be incidentally mentioned,—that crosses between different kinds of silkworms have often been attempted, and with some success, but this subject requires too elaborate treatment to be conveniently dealt with here.

8. Of the remaining cocoons, after the selection has been made for breeding, a further sorting will have to be made.

The French growers sort the cocoons of the single common silkworm (*Bombyx Mori*) into as many as nine varieties, distinguishing the good ones from those in which the worm has died, and making other distinctions required by the trade. The reeling of silk from the cocoons is nearly all done on the continent of Europe, and principally in the south of France. As a branch of manufacture reeling is unknown in England, which latter country only works up the reeled silk. The trade

in cocoons would therefore be, at least at first, with France, and, for the purpose of ascertaining what assortment of cocoons was required, it would be necessary for the grower to put himself in communication, through his agents, or otherwise with the manufacturers of that country. There would be no difficulty whatever in this, and when once it were ascertained in what manner the cocoons should be sorted, there ought to be little practical difficulty in sorting them. In despatching specimen bales, the point of importance would naturally be to make the bales as like the samples as possible; and probably at first it would be well to make as many distinctions in the cocoons as were readily noticeable, and to err on the side of over-minute distinctions rather than otherwise. The manufacturers would at once point out which distinctions were of importance, and which not so.

9. As in the case of good cocoons, the chrysalis would in a longer or shorter period eat its way through, and perforate the cocoon, it is necessary, where the cocoons are intended to be reserved for reeling, to kill the chrysalis carefully. This is done in various ways,—by exposing them to the sun, by placing them in boiling water, or by placing them in an oven with a gentle heat. Where the cocoons were intended to be packed for export, the first or last plan would probably be found to be the best.

Damaged cocoons, and those perforated, and almost all classes of wild cocoons, have a value, as, where they cannot be reeled, they can still be turned to account for spinning.

10. There still remains to mention the very important question of the cultivation of the more important articles of food of the silkworms. The discussion of this has been avoided. many of the necessary descriptions of food will be found growing wild in the jungles. In the case of these trees, it will not be difficult to study their habits. A list of the principal trees on which the several classes of silkworms feed will be found in Appendix A in answer to Question (4). Further information on this subject will, no doubt, be gradually obtainable as the necessity for the cultivation of food-stocks arises. Meanwhile, very much can be gathered from the practice of the native silkworm-growers on this as on other points.

The utilization of the less valuable woods in the fire-protected forests of the Central Provinces, by iron-making. By G. Brandis, Inspector-General of Forests, dated the 8th July 1879.

MY late inspection of the Reserved Forests in the Central Provinces (in 1876 and 1877) has convinced me that in the forests which have now during a series of years been protected from fire, in addition to Teak, Bija-sal, and the other more valuable timbers, large quantities of wood of the less valuable kinds are growing up, which it will be very difficult to utilize. And yet, unless we can cut and utilize these less valuable kinds, the rational working of these forests will become exceedingly difficult, if not impossible. There are, it is true, a few forest tracts where Teak, Bamboos, and other valuable kinds have the upper hand, and where the difficulties here adverted to do not exist; but these favoured tracts occupy a small proportion only of the total area under protection from fire.

In a few cases charcoal-making may enable the Forest Administration of the Central Provinces to utilize the wood of the less valuable kinds, and in some cases a sufficient demand for firewood and inferior building wood may spring up. But in the more remote localities the demand for charcoal, fuel, and inferior building wood is exceedingly limited, and large areas will remain, where a dense and luxuriant forest is growing up under present efficient protection, in which Teak and the other valuable timbers form only a small proportion. The grassy glades and other blanks in these forests are rapidly filling up with dense forest, but in those places a large proportion of the material now growing up will be a burden and a source of difficulty hereafter, when a rational system of management and working is attempted.

The only mode of utilizing this abundance of wood in some of the more remote portions of the Reserved Forests of the Central Provinces, which I can devise at present, is by means of iron-smelting with charcoal. Iron-making

existed, and still exists on a small scale, in the vicinity of some of the Reserved Forests, particularly in Bijeragogarh, those parts of Balaghat which adjoin the Mandla district, and near the Moharli Forest of Chanda. But iron ore is found and traces of former iron-smelting exist, in many other localities besides. The increased cost of charcoal, which was the necessary consequence, at the outset, of a strict protection of the Reserved Forests, has probably in some cases been the chief cause of the cessation of the charcoal iron industry; but as the forest growth in these Reserves increases, the material for charcoal-making will become abundant, and the cost of charcoal should be no obstacle to the revival of the iron industry.

I am not now prepared to enter into the financial aspect of the question. It is possible that at the present low price of iron, the renewal and extension of the old charcoal iron industry may not be found to be remunerative; but the question can only be solved by actual experience, and I am of opinion that the experiment should be made. Owing to the pressing financial difficulties, the present time is not favourable for a scheme of this kind; but sooner or later a commencement must be made, and an officer with practical experience of iron-making with charcoal will have to be employed to set this business on foot.

At the outset this officer should make himself acquainted with the chief iron-producing tracts and other localities rich in iron ore, which are conveniently situated so as to be provided with charcoal from any of the Government Forests, whether First or Second Class Reserves, and he should then proceed to select one locality where the experiments might most conveniently be commenced. The operations would first be conducted upon the Native plan, but it would be his business gradually to improve the furnaces and other arrangements. Should he succeed in making iron-smelting on this plan self-supporting in one locality, operations should then be commenced in another locality, and might be gradually extended as opportunity might offer.

The question, of course, is whether the iron produced can be sold at remunerative rates. It cannot be expected that even in the most favourable case the profits realized will suffice to cover the pay and travelling allowances of the officer employed. But, besides this item, the other outlay will be small, and is sure to be covered by the sale of the iron made, or by the royalty to be paid by the smelters, in case it should be decided to let the iron-smelters work on their own account.

Thus the outside loss which this experiment would involve, if unsuccessful, would not be considerable, and such a risk the Forest revenue of the Central Provinces is well able to bear.

Should the officer deputed for this duty succeed in this business in the Central Provinces, there are other parts of India where similar operations might, with great advantage, be undertaken; and I would specially mention the forests in some parts of the North-West Himalaya, where deodar is as yet the only wood that can be utilized on a large scale, and where it is most desirable to develop a demand for the wood of oaks and the other coniferous trees which are associated with deodar. The only other plan to utilize the woods of the other conifers would be by impregnating them with antiseptic salts, so as to make them more durable. The question of iron-making by means of charcoal is one of great importance for the development of rational forest management in India; and if we succeed in establishing an improved system of producing wrought iron in small furnaces by means of charcoal, we shall have accomplished a task, the importance of which for forest management in India, and generally for the development of the resources of many naturally poor districts, can hardly be overrated. The old Native iron industry has for many years past gradually declined in most places, partly because imported iron has been cheaper, and partly because the forests have become exhausted under a reckless and irregular system of cutting and burning. Wherever fire protection has been established in the Government forests, the difficulty arising

from the scarcity of wood has now been removed. An abundance of wood is now growing up, and both the forests and the interests of the population in the vicinity will profit if the wood now produced in such abundance can be utilized for the manufacture of iron.

It may here be mentioned that I have entertained the plan here sketched for years, and that while in England on leave in 1872-74, I discussed it with eminent metallurgists, both practical and men of science, and that I have received every encouragement. I have been told on the best authority that if we can succeed in establishing something like the Spanish (Catalan) process of iron-smelting in small furnaces,—in fact, if we can succeed in improving the present Native process,—charcoal iron industry may yet have a future in India.

The Collection of, and Revenue from, Myrobalams in the Southern Division of Bombay.

Extract from the Report of the Conservator, Col. Peyton, for 1877-78.

THE following is a brief sketch of the departmental collection of myrobalams carried on during the past season, compared with the farming system or auction-sale of the right to collect them since 1869-70.

As in the farming system the sales give right during the Fasli year, that is to say, between the 1st August in one year and the 31st July in the next, which embraces the whole of a single fruiting season, so also, for comparison sake, is given the full period covering the departmental collection.

The following exhibits the receipts and expenditure on account of the departmental collection of myrobalams during the season beginning with October 1877 and ending with 31st May 1878: estimate compared with actuals; fractions of rupees excluded:—

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226 THE COLLECTION OF, AND REVENUE FROM, MYROBALAMS

No.	Collectorate.	RECEIPTS.				EXPENDITURE.				Net Profit.
		Special Estimate.	Actuals.	Increase.	Decrease.	Special Estimate.	Actuals.	Increase.	Decrease.	
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Kanara ...	42,438	51,083	8,624	...	19,488	21,469	1,981	...	29,593
2	Belgaum ..	74,600	61,437	...	13,163	25,240	14,064	...	11,176	47,373
	Total ...	1,17,038	1,12,499	8,624	13,163	44,728	35,533	1,981	11,176	76,966

N.B.—1. Quantity of fruit it was estimated would be collected : 8,380
candies of 560lbs. each in weight.
Do. do. actually collected 7,823
candies of 560lbs. each in weight.
or 557
candies less.

2. The net profit was estimated at Rs. 72,310
That actually obtained was " 76,966 or
Rs. 4,656 more.

The increase over estimate in Kanara by the large sum of Rs. 8,624 is very satisfactory, and the increase in expenditure by Rs. 1,981 is due mostly to 261 candies more fruit than estimated having been collected, and, therefore, its carriage and collection to be paid for.

In the Bidi Taluka of Belgaum there is a decrease in receipts, compared with estimate, of 211 candies of fruit and of Rs. 1,580. This would not have been so, but for the severe fever that prevailed in most of the forest villages of this taluka in November and December, when much fruit rotted in the wet grass from want of hands to collect it.

In the expenditure compared with the estimate in this (the Bidi) taluka there is a saving of Rs. 6,924, due to certain carting charges, amounting to Re. 1 for every candy of fruit collected at some general depôt, and the purchase of bags and carts, &c., having been avoided ; also to a smaller quantity of fruit than estimated having been obtained.

The hill people of this taluka, like as in Kanara, showed the greatest good-will, and expressed themselves very gratefully for the introduction of a system that they had ever since 1874 been asking the Conservator of Forests for.

The result of the collection or receipts compared with estimate in the Belgaum Taluka of Belgaum was very unsatisfactory; but as the reasons were fully gone into in the special report submitted last month by the Conservator, it is needless to go over the whole again; it would, therefore, appear sufficient to say that, even under the very unfavorable circumstances and drawbacks carefully detailed in the special report referred to, the net profit or result even in this taluka during 1877-78 more than doubled the average net profit of the previous seven years. The receipts were Rs. 15,017 or Rs. 10,983 less than estimated, and the expenditure Rs. 4,278. There was a saving here also of Rs. 4,252 on the same account as in the Bidi Taluka.

But, to proceed with the comparison, the following are the amounts realized from 1869-70 to 1876-77 at the auction-sales of the farms or right to collect myrobalams in the Southern Division :—

Years.	Kanara.	Belgaum.	Total.	REMARKS.
	Rs.	Rs.	Rs.	
1869-70 ...	.....	18,934	19,934	One year in Belgaum only.
1870-71 ..	6,014	17,917	23,931	For seven years in Kanara and Belgaum.
1871-72 ...	6,661	15,570	22,171	
1872-73 ...	6,192	13,227	19,419	
1873-74 ...	6,207	20,231	26,438	
1874-75 ...	5,125	13,616	18,141	
1875-76 ...	5,680	18,507	24,187	
1876-77 ...	10,075	29,815	39,890	
Total ..	45,904	1,38,383	1,74,187	
Average of 7 years ...	6,557	18,926	24,883	

It will be observed that the amount realized in 1876-77 exceeded that of the previous year 1875-76, by the large sum of Rs. 15,693; in Kanara the excess was Rs. 4,385, caused a good deal by some departmental collection in the less important hirda-bearing talukas having been thrown in with the general farm revenue, and by the greatest interest taken regarding the subject during the two previous years, which made the bids for the farms rise above the average; but in Belgaum the sudden rise, it is well known, was due to a split in a family of kulkarnis, who in former years conjointly bought

up the right to collect in the Belgaum taluka, and where the bid jumped from an average of Rs. 3,745 to Rs. 14,510. It is not, however, likely that the 1876-77 rates would have been maintained, had the farming out of this right been continued, as one of the contending parties would certainly have given way, or both come to an understanding as of old; for the rest the yield will be seen to have fluctuated considerably, and been more in 1869-70 than in 1875-76, which shows it was combination amongst the kulkarnis (Government village accountants) that prevented any reasonable advance in sales until the split amongst them took place.

To continue, however, the comparison between the first year's general departmental collection and that of the farming system, the average of which for seven years is shown at paragraph 90 to be Rs. 24,883, and compare this with the actuals of 1877-78, shown in the statement at paragraph 85, we have a net increase by departmental collection of Rs. 52,083, that is to say—

From 1870-71 to 1876-77 the right to collect sold on an average for	Rs. 24,883
In 1877-78 the departmental collection gave a net income of	Rs. 76,966
Showing a balance in favour of 1877-78 of	„ 52,083

The net revenue has, therefore, trebled during the first year if anything like a general departmental collection, and, as will be seen from the footnote at paragraph 85, exceeds the estimate of net profit by Rs. 4,656.

Moreover, it is but right to observe that, in the general departmental collection under notice, two very important hirda-bearing talukas (Sirsi and Siddapur in Kanara) that would probably have added Rs. 18,000 more to the net profit of the collection, were left out.

It is but right also to observe that a more fair or legitimate means of deriving a forest revenue does not exist; inasmuch as the Government have ever maintained their right to this produce by selling the farms, or right to collect it, every year by auction-sale, and, therefore, as much right to collect and sell it departmentally at depôts in the same manner as it does its timber in this division.

The following are a few of the many advantages claimed for the departmental system :—

(a). That the very liberal scale of payments providing for the collection of myrobalams enables men and women to earn an average wage of from 4 to 6 annas, and children from 2 to 4 annas, daily about their own and neighbouring village lands from November to May every year, and, therefore, draws the hill people and the other classes that formerly preyed on the forest by chopping and collecting firewood, towards the department in a manner so touching their interests as to make them readily reconcile with our own.

(b). That in securing this, and with the fine additional establishments engaged in the superintendence that the system can so well afford to pay for, the suppression of fires over the area the tree (*Terminalia Chebula*) prevails—say about 2,000 square miles—is secured, and, therefore, a preventive, over so far, of an acknowledged scourge found.

(c). That it secures beyond all manner of doubt an immediate fine revenue, which the experience of the past years of farming system does not justify expectations of, or even anything like a near approach to; besides, it gives an acquaintance of the hitherto but little thought of ghats, and secures us against any undue encroachments or growth of privileges in that direction.

(d). That with the suppression of the usual fires that yearly run through the whole area, often entirely destroying many fine old bearing trees and injuring thousands of others at the time of flowering, an immediate increase of quarter more revenue may be expected. Further, final suppression cannot fail to enhance revenue prospects enormously in this respect by the encouragement that will be given to the reproduction of this tree over the tracts it favours and loves to inhabit.

Already the greater repressing of the usual fires during the last season has produced the most marked effect in the hirda crop, which is reported to be unusually fine this year in the Supa, Bidi, and Belgaum talukas; and with the improved prospects, and the remaining area of his charge taken up, so that the whole is now embraced in the departmental system, the Conser-

230 THE COLLECTION OF, AND REVENUE FROM, MYROBALAMS, &c.

vator has felt himself justified in sending in a revised estimate, of which the following is an abstract :—

Actuals of Receipts and Expenditure ending with the 31st May 1878.	Estimated Receipts and Expenditure ending with the 31st May 1879.	REMARKS.
Rs.	Rs.	
Receipts ... 1,12,499	1,68,300	The estimated balance in favour of the season ending with the 31st May 1879 is Rs. 25,718.
Expenditure ... 35,533	65,616	
Balance or Net Profit ... 76,966	1,02,684	

The departmental system also, with the fine establishment it can afford to pay for, and which must not be grudged, is sure to promote the enquiry into, and collection of, other forest products, and, indeed, so it has already ; reference, however, to this is reserved until information is more complete.

III. REVIEWS.

Annual Reports of the Superintendent, Royal Botanic Garden, Calcutta, the Superintendent of the Government Cinchona Plantations, and the Government Quinologist for 1878-79.

THE Report of the Royal Botanic Garden, Calcutta, for 1878-79, has now been published, with the Review of the Lieutenant-Governor of Bengal, and we make a few notes which may be of interest to our readers.

The different species of India-rubber-giving tree, which are now being experimented on, have been again reported on. The Para rubber (*Hevea brasiliensis*) has not been successful, Calcutta being apparently too cold and changeable a climate for it. The Ceara rubber (*Manihot Glaziovii*) has, however, done well, and seeds and plants are being largely distributed.

As we suggested in our last Volume, p. 288—suggestion that was founded on inspection of the plants growing in the Saharanpur Garden—the seeds received from Dr. Forbes Watson proved to be nothing but the well-known Wilayati Babúl (*Acacia Farnesiana*). The rain tree (*Pithecolobium Saman*) continues to do well as usual; while the Carob is a distinct failure; as also would seem to be the much over-estimated but now, happily, almost lost sight of, *Baobab*.

On the subject of "Bamboo and other paper-fibres" we extract the following:—

BAMBOO AND OTHER PAPER FIBRES.

"In my last report I gave the result of three years' experiments in cropping bamboo in the way recommended by an English paper-maker (Mr. Routledge) in a pamphlet published by him and entitled "Bamboo considered as a paper-making material." Mr. Routledge's plan from the first appeared to me

to be unsuitable, but I felt bound to try it. I did so, following his own printed instructions. The result showed that the yield fell far short of Mr. Routledge's calculations, and that to grow bamboos in his way in the vicinity of Calcutta as a source of paper-fibre did not promise to be a profitable investment for money. The six clumps of bamboo previously reported upon have been carefully protected during the year, and to-day (10th July) I have collected from them all their succulent young shoots suitable for Mr. Routledge's process. The total weight of these shoots is one hundred and twenty pounds, or at the rate of twenty pounds per clump, and (allowing eighty clumps to the acre) at the rate of sixteen hundred pounds per acre. This result affords still further confirmation of the unsuitability of the mode of cultivation and cropping originally advocated by Mr. Routledge. I understand, however, that Mr. Routledge does not now approve of his own plan of cutting down all the shoots of a bamboo clump, but recommends that instead of this only a few shoots should be taken annually. As this is the principle on which bamboos have been cut in India from time immemorial, no experiments on its feasibility are required. The value for paper stock of the fibre contained in the succulent shoots of bamboo is a matter to be settled by practical paper-makers, and is one on which I have no opinion to offer. Accepting Mr. Routledge's estimate of its value as correct, the questions that remain to be settled are, whether commercial success can be obtained ; (1) by forming plantations of bamboo in order that a certain proportion of the succulent shoots, yielded by them, may be collected annually ; or, (2) by collecting in the forests and conveying to a paper-stock factory the immature shoots of wild bamboos ; or, (3) by fitting up a floating paper-stock mill, and moving it about on rivers by the banks of which bamboos naturally abound, so that the expense of cultivating and of carrying the raw material may alike be obviated."

The Reports of the Superintendent of Cinchona Plantations, and of the Government Quinologist in Bengal, for 1878-79, have also been published. From the former we gather that

an extension of 120½ acres have been made chiefly in the Sittong Block. This area was all planted with red bark (*C. succirubra*), but a great number of plants of yellow bark (*C. Calisaya*) were also raised. It may be worth noticing here that most of the transplanting is done during the cold weather, but that this year the failure of the cold weather rains prevented it.

The year's cuttings gave about 2,000lbs. per acre of red bark, while cuttings of yellow bark gave 1,882lbs. per acre. The total amount cut was 246,880lbs. of red bark, 13,967lbs. of yellow, and 812lbs. of grey bark (*C. micrantha*). The yearly produce taken at the average of the last four years is 256,000lbs.

The amount of cinchona febrifuge manufactured during the year was 7,007lbs., and the cost of manufacture was Rs. 10-14-7 per lb. The financial aspect of the sales of febrifuge was as follows:—

Receipts	... Rs. 1,32,519
Expenditure	... „ 78,983

Surplus	... Rs. 53,535, or including the difference
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in value of the stock on hand at the beginning and end of the year, Rs. 42,412.

The Journal of Forestry and Estates' Management.

THE number for JUNE opens with a notice of the damage done to foreign and home species by the severe winter of 1878. *Eucalyptus Globulus*, it seems, will not stand a temperature of 20° Fahrenheit. Nearly all other species of 'Gum' collected (except in a few very favored and sheltered localities) succumbed. This information should be valuable in India, when finding that many *Eucalypti* will not suit our plains, we run to the other extreme, and plant them at too great elevation, in our hill-districts.

An interesting note on *Catalpa* is given. The species is *bigonioides*, but the early blossoming variety, *speciosa*, is recom-

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mended. We have seen a few seeds of this tree in the Changa-Manga Forest Garden, where its growth has been most remarkable. The wood, according to Professor Sargent, of Harvard University (Cambridge Mass.), is remarkably soft; its specific gravity (ratio of weight of the wood to the weight of an equal body of water) is .405; black walnut being .577, American elm .649, and white oak .662.

Though so soft, (and therefore presumably not a good fuel wood,) it is almost indestructible, and this fact, says Professor Sargent, presents an interesting problem for solution.

It likes a rich soil. A specimen grown in the "rich prairie soil" from Brownsville, Nebraska, shows four annual rings from the seed: nevertheless it is $9\frac{3}{4}$ inches in circumference, "and the growth of the first two years ($1\frac{1}{2}$ inch in diameter) has already "turned into hardwood."

It may be noted that the *speciosa* variety has larger flowers, larger and much flattened seed pods—often 16-18 inches in length, shorter and broader seeds, with wings of equal width to their rounded ends, which are terminated by a copious fringe of stouter hairs. The wood is heavier also.

The paper on "Limestones and Limes" is continued, and a list of valuable results obtained by the use of lime on the soil is given.

A paper only just begun, (with some general remarks having little or no bearing on the subject), and entitled the "Important Functions of the lower branches of trees in open situations," will evidently be worth reading, now that the author has had the luxury of spending four pages in telling us how well off England is for beautiful trees in parks and hedgerows, and how much better it is in this respect than France. He is evidently going to explain that the removal of lower branches is injurious, and has a tendency not to encourage the main stem to a tall growth, but to develop large upper branches, and so throw the tree off its balance.

Then after a brief paper about planting conifers (in parks, &c.,) in France, which seems to be neglected, comes a long paper from Dr. Croumbie Brown containing all sorts of people's opinions about a School of Forestry in Britain, the reasonable argument for which is always destroyed, or weakened by the nonsense

that these well-meaning, but ill-informed persons insist on talking about Indian Forest Training in connection with the subject.

Can't the good people be content to have their own school in which people shall be taught to plant what is wanted for *English* Foresters, and let us Indian Foresters alone, and leave us to train our own candidates in the way we find best suited to our wants?

Somebody, it seems, has been cutting off the branches of the spreading boughs of that chestnut tree under which Longfellow's "Blacksmith"—he of the long black hair and perspiring forehead—used to swing his heavy blows. The boughs were made into an arm-chair and presented by the children of Cambridge to the poet on his seventy-second birthday (February 27th, 1879,) whereupon the poet wrote some rather pretty lines "From my Arm-chair," which the Forest Journal reprints.

The excellent plan of printing a table of prices of different timbers, &c., with a brief comment on the whole, is continued, but why not give the table in the ordinary page and not on that fearful yard length of infolded paper?

Then comes a paper on the "Timber Trees of Classic Times," which we noticed in our last review. By the way, some pines are dicecios, at least the deodar is often so. The *Elate* of Theophrastus is said to be a pine, but the botanists have attached *Elate* as the name of one of the wild date-palms; and the description quoted would apply better to a date palm than to a pine.

The July number.—The following gem deserves to be extracted: we regret that space does not allow of our giving more, but this is the choicest part: "We return our cordial thanks to the Editor of the Journal of Forestry for the strong argument in favor of the Indian Forest service. We have ourselves contended that the system of training our forest officials in the admirable Forest school of Nancy has on the whole produced excellent results, and that at the same time it is cheap and economical. All arguments that have been directed against it are based on incorrect facts or mistaken inferences. We have further contended that the system on which the Indian forest administra-

tion has been steadily progressing (in spite of many difficulties) is on the whole a good one: that the lines on which it is advancing have been correctly laid down; and that the only danger to the work consists in the application of too great parsimony, which, while it takes an increasing share of the Forest income as revenue, grudges the expenditure of a proper share on well-trained and competent establishments, and on a more careful cultivation of the forest area."

When a writer in a would-be respectable journal has nothing better to urge on the subject than such stuff as we subjoin, we feel that there is little chance of any rational person being misled or allowing our system to be thoughtlessly disturbed. We do not know which most to wonder at in this 'elegant extract'—the audacity of the mistatements with which it abounds, or the uncalled-for brutality of its invective.

"A considerable amount of public attention is again being devoted to the vital subject of tree planting in India, and the preservation and judicious utilizing of the existing forests of that country. Many able letters have appeared in the *Times* and other leading papers, pointing out the hurtful extent to which denudation has been carried on in several sections of that wide-spread empire, and the evils which have necessarily followed the complete clearance of forest trees from extensive areas of dry and sun-parched lands. The efforts now being made by the Indian Forest Department to prevent further denudation appear to meet with only a partial success, arising from the extent to which the forests have already been destroyed in many districts, and the arbitrary manner in which the Forest Department insists on stopping all clearance of forest lands within the scope of its powers of interference. This is undoubtedly the effect of the unsuitable training received by the officers of the Forest Department in the French Forest Schools, and the application of the red-tape officialism taught there to the totally different circumstances of British India. Such egregious errors are the natural result of the training received and the ideas imbibed in a forest school specially adapted to the circumscribed rule and limited wants of the

French nation, but totally inadequate to meet the ever-varying wants and circumstances of the far-spreading British dominions."

"The teeming multitudes that cultivate the rich but often treeless plains of India cannot have their scanty supply of timber totally cut off at short warning without suffering the greatest hardships for want of it, and incurring wasteful loss by being compelled to dry and burn the valuable manure, which ought to be applied to reviving the fertility of the exhausted crop-bearing land. Nevertheless, the hybrid officialism which rules the Indian forests has committed this cruel and unnecessary wrong, through its inability to understand the primary and simple principles which guide rural life in India, and its disinclination to vary its mode of treatment to meet the wants and circumstances of the inhabitants of each district."

"The arbitrary measures taken by the Forest Department to prevent denudation, and which are strictly enforced by its officials without the smallest thought or discrimination as to the varying wants and peculiarities of the inhabitants, are causing wide-spread discontent and unnecessary ill-feeling among the natives, who find their natural supply of timber and fuel peremptorily stopped, without having the means to supply the want from other sources. The consequence is, they have to starve their crops for want of manure, which they are driven to use for fuel when their supply of wood from the forests is abruptly cut off, or the price of it raised so high as to be totally beyond their powers to purchase."

"A thorough investigation into the system and management of the Indian Forest Department has clearly become a pressing necessity, and a radical change in the method of training its officers is absolutely necessary, so as to thoroughly eliminate the antiquated ideas with which they have hitherto been crammed, and which have proved to be as unsuitable to the wants and circumstances of India as they are well known to be preposterously behind in the march of modern progress and the actual demands of science and practice at the present day."

It is now time to turn to Mr. Burrow's excellent paper on "Pruning." It is indeed impossible that any elaborate system of pruning can, in the enormous forests we have, be carried out.* We are also obliged to preach abstention from pruning, because the men and the tools with which it is usually done are both so bad that it is safer to act on the saying of DeCourval: "Better never to touch a tree than give it into inexperienced hands." Nevertheless what with the amount of work we have to do in nurseries and artificial plantations, what with the extent of road planting and other works of district arboriculture, we are called on to help in or advise on; it is a matter of great importance that the subject of pruning should be adequately understood. And Mr. Burrow's plain and practical paper should be read by all foresters in India who have the care of plantations. In this number, too, Mr. Carr Ellison returns to the subject of the functions of the lower branches of trees.

Mr. Barry continues his notes on French Forestry at the Exhibition, and describes the forests of Algiers. The forests of *Cedrus Atlantica* (so like our own deodar) cover 76,549 hectares. Some of the trees attain a large size. A block of wood was exhibited from a tree 5 feet in diameter that was computed by the rings to be 485 years old. Trees 60 to 70 feet high and from 16 to 20 feet in girth are common. The wood is of a rich brown colour. The other forests are of *Pinus halepensis*, the cork oak, *Q. ilex*, *Q. Mirbeckii*, and several other species.

Then comes Dr. Brown on Forest Schools. He will get one, he says, (and here I am afraid the doctor will be thought a little profane, but his intentions are excellent):—

"It may not be in my way,
It may not be in my way
But in His own way,
The Lord will provide."

We must do Dr. Brown the justice to say that he is always fair in his argument. As long as he advocates a British School for British Foresters, for the *arboriculture* which there constitutes

* Nor is it necessary. In a large area of natural forest the thinnings and the "cleaning" of the forest ought to keep the growth so orderly as to make pruning rarely necessary.

forestry, we entirely sympathize with him, and he courageously prints the opinion of those who support this view, and do not try to force the system on Indian candidates by ridiculous libels on Indian Administration or by ignorant nonsense on the subject of the cost of education at Nancy and the fitness of the instruction there imparted.

Those with a turn for Forest Romance will read with pleasure Mr. Evershed's paper on Sherwood and Robin Hood in this number.

Next comes an account of the Journal's Foreign Exchanges. Though our Indian Journal is regularly received, the English Journal never condescends to notice it. See what comes of being a "hybrid official!"

The Editor is delighted that the "Finnish Forest Union," giving an account of *modern forest science*, praises a whole series of books, not one of which contains a syllable on scientific forestry, and includes Dr. Cleghorn's "Forests of Southern India," about the least noteworthy of the works of that amiable and excellent officer, and which consists of a badly arranged compilation of extracts from very stale official reports.

We can only notice very briefly an account of the forests of Alabama. The state (one of the Southern States of the Union) consists of 50,000 square miles, of which it is estimated $\frac{7}{10}$ ths are still forest. The southern part is pine forest, (yellow pine — *P. australis* on the sandy uplands, and *P. serotina* and *P. Taeda* below). Then comes *Taxodium distichum* in the tide water region and white Cedar (*Cupressus thyoides*). Next northward comes a magnificent region of oak forest having several species; and the most northerly belt of all contains Maples, Elms, Beech, Hickory, Walnuts, Tulip trees (*Liriodendron*), &c., &c.

The *August* number explains the mystery of the "Vanilla" tree, which some one wrote to the *Times* about. It is the beautiful *Paulownia imperialis*, with its lilac shaded flowers in large loose panicles. This is extensively planted in Paris, and gives out a faint pleasing odour, which may be likened, if you please, to vanilla.

A well deserved tribute of thanks is paid to SIR HENRY W. PERK, Bart., owing to whose liberality the beautiful lands of the well-known "Burnham Beeches" have been secured to the public for ever.

The paper on the *Abele* poplar (*Populus alba*) should be read. It occurs in some of our forests, but is not common. The wood is light and soft, like that of *P. ciliata* and others of our poplars, but it is tough.

There is a long paper of Dr. Brown's on Primary Schools or Rural Economy, including forestry. No doubt a great deal might be done by introducing into Primary Schools some notions of agriculture and of forest economy as well. For England, there is a charming primer on agriculture by Mr. Tanner, similar in size to the well-known "Science Primers," but not actually forming part of that series. Such Primers, on other subjects as forest economy, uses of trees, &c., might be prepared, and would do good service as readers in Elementary Schools, even where it was not found practicable to establish schools expressly for the purpose of teaching agriculture.

The Royal Agricultural Society's Show occupies a good deal of space, and there are numerous short notices of interest, which space prevents our noticing.

We have also received the following:—

Medlicott and Blanford's Manual of Indian Geology.

Review of Forest Administration in the several Provinces for 1877-78.

Suggestions regarding Forest Administration in Assam, by D Brandis, F.R.S., C.I.E., Inspector General of Forests.

Suggestions on the Management of the Forests of the Forest School Circle, N. W. P., by the same Annual Forest Administration Reports of Bengal and the Central Provinces for 1878-79.

IV. NOTES, QUERIES AND EXTRACTS.

Mechanical difficulty in Growth of Plants and Animals.

IN reading reports and discussions on natural science, to which I am, from great pressure of other occupation and studies, only able to give a cursory attention, I cannot find any allusion to the *mechanical* means by which the growth of organized creatures is produced, especially when that growth takes place in opposition to the direction of gravitation. The explanation at which I have arrived of this phenomenon may probably be known to physiologists, and may have been acknowledged or disproved; any way I think the subject might be fairly discussed in a popular journal such as yours.

The growth of the roots of a plant and of drooping branches not being in opposition to the attraction of the earth, presents only the difficulties which arise from vital action, but the increase of a plant in height requires also explanation as to how the work is done of lifting vegetable matter higher and higher; capillary attraction can bring fluid to the summit of a tube, such as the stem of a plant, but the fluid cannot overflow at the top, since in that case the matter of the tube would lift the fluid above itself; but when a tube is full of fluid additional heat expanding this fluid would cause it to overflow at the top of the tube. As the sap contains solids in solution from this the fluid could deposit an additional length of tubing, in which again an additional length of the column of fluid could be absorbed, so the heat of each day would build up a higher vertical tube, and capillary attraction would account for the colder fluids produced at night or rising from the root filling the vessels to their extremities. It seems to me, therefore, that the work done in lifting vegetable matter to the apex of a plant is due to the increase of heat in the day time; that then the watery particles are evaporated, and the solid left deposited in the form of cylindrical vessels of small

bore. In animals the prostrate posture of rest allows of growth without the difficulty of resisting gravitation; it is well known that deficiency of sleep (perhaps more accurately of rest) stunts the growth of animals, and that illnesses which keep children in bed during their years of growth almost always cause a rapid increase of stature; surely this arises from the newly-formed tissues having no gravitation to overcome, and therefore developing rapidly. Probably if a child were taught to take rest in a vertical position, it would not grow tall, but develop in breadth.

The work done in increasing the stature of plants every year must be enormous, in one summer thousands of tons of vegetable tissue must be raised through heights varying from a few inches in an oak, to 20 or 30 feet in a hopbine, and much more in a liana, or tropical creeper. I presume in winter the cold constricts the vessels, and so prevents sap from rising, hence there is no growth at that season.

Taunton College School.

H. P. KNAPTON.

[*Nature*, July 24th.]

A MEMORANDUM by the Inspector-General has just been published, containing remarks for the guidance of Mr. Bagshawe, Deputy Conservator of Forests, who has just been deputed to the forests of the Kuram Valley under the orders of the General Commanding.

From the Memo. it appears that the chief points which are to be considered are :—

1. The timber and fuel supply of the Cantonments.
2. The export of timber to other districts.
3. The demarcation of 'Reserved Forests.'

The last point seems to be the one which is considered of greatest importance, although the first is the one which will receive at present the greatest attention. It is evident that some one has proposed the establishment of sawmills, but the Deputy Conservator is cautioned that such mills must not be set going in a hurry.

Mr. Bagshawe is also desired to study the question of utilization of the Indus Palm, which is said to be very common

in the lower part of the Valley ; on this subject we extract the following :—

“ *Chamærops Ritchiana*.—In the lower part of the Kuram Valley the Indus Palm (*Chamærops Ritchiana*, Mazri, Mzarai) is common. The leaves are used for mats and cordage, and might possibly yield material for paper stuff. During the winter, Mr. Bagshawe may have an opportunity of studying the question, whether it would pay to export the leaves of this Palm for the purpose of paper manufacture. There is a steady export from Spain to England of the leaves of *Chamærops humilis* for paper stuff. But even if this suggestion—as it possibly may—comes to nothing, the Palm is a most useful tree, and the question of protecting some of the tracts where it grows, is well worthy of consideration.”

SOME samples of hard-wood lumber made out of common wheat straw have lately been exhibited in Illinois, and have, it is stated, attracted much attention among the lumbermen. The wood has all the polish and finish of the hardest black walnut and mahogany. An ordinary straw board, such as is usually made at any paper mill, is used for producing it. As many sheets are taken as are required to make the thickness of lumber desired. These sheets are passed through a chemical solution which thoroughly softens up the fibre and completely saturates it. The whole is then drawn through a succession of rollers, dried and hardened during the process, as well as polished, and then comes out of the other end of the machine hard dry lumber ready for use. It is said that the chemical properties hardening in the fibre entirely prevent water soaking, and render the lumber combustible only in a very hot fire. The hardened finish on the outside also makes it impervious to water. The samples which have been exhibited could hardly be told from hardwood lumber, and in sawing the material the difference could not be detected.—*Pall Mall Budget*.

THE *Indian Agriculturist* has an interesting note taken from the *Country Gentleman*, in which it is said that in Vermont the shoots of the apple, pear and peach were observed to be frozen

stiff when the thermometer sunk to 10 degrees above zero. In connection with this I may mention that *Senecio vulgaris*, the Groundsel, one of the most common weeds in Europe, an annual, may often be seen completely frozen in the early morning of a cold winter. If examined under the microscope in a cold place, the cells will be found filled with ice crystals. As the sun rises, the ice melts and the plant continues to grow—no injury resulting from the freezing.—D. B.

PRESERVATION OF TIMBER.—M. Lostal, a French railway contractor, is said to recommend quicklime as a preservative for timber. He puts the sleepers into pits, and covers them with quicklime, which is slowly slaked with water. Timber for mines must be left for eight days before it is completely impregnated. It becomes exceedingly hard and tough, and is said to never rot. Beechwood prepared in the same manner has been used in several iron works for hammers and other tools, and is reputed to be as hard as iron, without the loss of elasticity peculiar to it.—*Timber Trades' Journal*, July 19th, 1879.

CANADIAN TIMBER ACT.—From Ottawa, Canada, the *North-western Lumberman* gathers the following relative to Dominion timber and lands:—Sir John Macdonald's bill to amend the Act respecting Dominion lands has been printed. It entirely prohibits any officer or *employé* of the Land Office from purchasing or speculating in lands. Townships are to contain 36 square miles each, and the land is to be laid out in blocks of four townships each. Sections 14 and 29 in every township are to be reserved for educational purposes. All surveyed Dominion lands are to be open for purchase at the rate of one dollar per acre; but the Minister of the Interior may withdraw any section from ordinary sale, and offer it by auction at an upset price of one dollar per acre. No patent will be granted to settlers till there has been three years residence on the land. Timber lands will also be open for settlement, but no sales of such lands will be made where the object of the buyer is to form a petty monopoly. Mill owners can secure the right of

cutting timber on limits by paying a bonus for each square mile—monthly returns of the quantity cut to be made to the Government.—*Timber Trades' Journal*, June 7th, 1879.

CHINESE METHOD OF RAISING WEeping TREES.—It is stated in Regel's "*Gartenzeitung*," on the authority of Dr. Bretschneider, physician to the Russian Embassy at Peking, that the Chinese raise weeping trees by reversing their extremities. Dr. Bretschneider describes the operation, which he asserts he has himself repeatedly witnessed, as follows:—"To raise weeping trees of *Sophora japonica*, they plant two young seedlings side by side. The tip of one of them is then bent downward and inarched on the base of the other, tip downward. As soon as the graft has properly taken, the tree that was doubled down is dug up, roots and all, and the roots, denuded of the soil, turned uppermost, and the stem attached to a stake in this reversed position. The stem of the tree, which serves as stock, is then cut off at the point of union of the two, and the roots of the reversed tree form the crown of the artificial tree. In this novel position they require shading from the sun until they have formed some branches." In this manner, we are assured by Dr. Bretschneider, as translated in the *Gardeners' Chronicle*, the Chinese obtain all their weeping trees.—*Garden*.

FOREST FIRES IN AMERICA.—Terrible forest fires are raging in the Alleghany Mountains in Pennsylvania, in the neighbourhood of Williamsport, and immense damage has been done to timber, mines, oil tanks, and farm buildings. In New Jersey a disastrous fire has raged in the woodlands in the northern part of Cape May county. More damage has been done by it than any fire that ever occurred in New Jersey. Part of the tract burned over was covered with a young growth which grew up on the site of the great timber fire of 1873. The exact area burned over is estimated at 30,000 acres, and not less than 4,000,000 cords of wood have been destroyed, besides hoop pole timber. From Wisconsin it is reported that fires along the densely timbered portions of the Chicago, St. Paul, and Minneapolis road, at intermediate places between

Eau Claire and Baldwin, west, and Camp Douglass, east, have been observable for some days past, but as the wind was calm no more than ordinary danger was apprehended. On a change of wind, however, matters became more serious, and embers and flames were scattered in all directions. All along the road between the above-mentioned places the fire raged with fury, carrying destruction to timber, fences, &c., with it.—*Timber Trades' Journal, June 7th, 1879.*

THE VANILLA TREE.—Some foolish person has been writing a note in the "Times" about tree planting in Paris, as follows:—"Any one interested in the planting of squares or boulevards, and with time to spare, would find a trip to Paris well repaid by a view of the Avenue d'Essling, now a mass of purple bloom, which quite eclipses the Chestnuts so familiar in this city. The Vanilla tree, with which that avenue is planted, has very handsome foliage, and would quite stand the London climate, making a pleasant variety and growing rapidly." This has caused many puzzled persons, who only know the Vanilla as a delicate hothouse Orchid, to ask what can be meant. The writer can only mean the common Paulownia, but he is courageous enough to write to the "Times" without taking the trouble to ascertain the proper name of the tree. Of course he also recommends it for use in London, without taking the trouble to enquire how it actually grows there, where it lives, but never makes any such growth or flowers so freely as we have noticed it about Paris. On warm soils in the south of England, and not far from town, it does much better and sometimes flowers freely. The Catalpa is a much better tree for London, so far as we have observed, and both grows and flowers very freely, even in the centre of the town.—*The Garden, June 14th, 1879.*

CONSTRICTED BARK.—This disease is occasioned either through the action of the roots becoming too feeble for the proper support of the tree, or through very dry cold air playing upon the trunk and branches of a tree which has become exposed. It is occasionally shown by the bark becoming indurat-

ed and losing its elastic properties, whereby the sap vessels get confined and their proper functions suspended. In the Plane tree the outer layers of bark peel off; in the Oak they become torn longitudinally; and in the Beech stretched horizontally. When in this hide-bound state the trunks often become covered with Mosses and Lichens, and are preyed upon by insects. The only sure remedy is scoring the trunk, and perhaps the main branches, right through the bark from the top to near the roots. The operation may be safely performed about mid-summer, and the relief given to the tree will become apparent directly. We have seen old apple trees renovated by scraping or stripping off a considerable portion of the rough old bark, and hide-bound young ones instantly revive after scoring. By leaving the inner layers of bark uninjured, considerable liberties may be taken with the rough external coating.—A. J. B.—*The Garden*.

CANKER IN TIMBER TREES.—This disease, though more frequently found upon fruit trees in orchards than amongst timber trees, sometimes attacks both the Elm and the Ash upon very wet soils, the drainage of which is imperfect. It is more especially found in low situations, where there is not a free circulation of air. It may also arise from an unwholesome substance in the soil becoming lodged in the vessels of the young shoots, causing blisters near the buds, and at the bases of larger branches. The parts affected are generally chosen by insects, whose larvæ keep the diseased spaces open by feeding upon their margins. It is not unusual to find fast-growing trees in the above situations attacked by canker. The only effectual remedies for the disease seem to be good ventilation by means of open cuttings or rides in the woodlands, and thorough drainage.—A. J. B.—*The Garden*.

Among patents regarding wood industries, lately described in the *Timber Trades' Journal*, is one called "An Improved Process for Preserving Wood from Atmospheric and other action"—J. Deleu, Courtrai, Belgium—dated November 12th 1878, and described thus:—

This relates to a process whereby wood is rendered com-

pletely water-tight, thus preserving it from decay when subjected to the influence of water, or other atmospheric action. The process is effected as follows :—A quantity of solid gutta-percha is liquefied by mixing paraffine therewith in the proportion of two-thirds of gutta-percha to one-third of paraffine ; the mixture thus obtained is subjected to the action of heat, and the gutta-percha thereby becomes liquid ; in which state it is introduced into the pores of the wood by exhausting the air by means of an air-pump from the pores of the wood, or by forcing the said liquid gutta-percha into the pores of the wood by means of a force-pump.

WE learn from a Queensland paper that Mr. Walter Hill has been sent on a tour of inspection to Great Sandy, or Fraser Island, a large irregular-shaped island lying off the coast to the north of the twenty-sixth parallel of south latitude, where it is reported that some valuable timbers flourish, notably the Kaurie pine. For some time past the Curator of the Botanical Gardens has been giving his attention to the propagation of some of the most valuable timbers indigenous to the Colony, and at one place he has formed a nursery of red cedar trees in which 30,000 plants have been successfully reared, and are now all in a flourishing condition. It is believed that a part of Mr. Hill's Mission to Fraser Island is to look for suitable sites for arboriculture, with the view of utilising the large number of red cedar plants he has reared. The red cedar takes from sixty to one hundred years to attain its best development, and this care for distant posterity is probably due to thoughtfulness on the part of the authorities who view with alarm the wholesale devastation and waste of the timber which from time to time take place in the Colony. It is said that there are yet plenty of cedar trees in the Queensland forests, but quite recently several million feet of this timber were swept out to sea in consequence of a fresh in the Mossman, Daintree, and Johnston rivers.—*Nature*, July 10th, 1879. *

THE United States Government has been prosecuting timber thieves, and has recovered over a million dollars from them,

* The red cedar here referred to is a species of *cedrela* allied to our 'Toon.'—Ed.

besides checking operations which had reached large proportions. These fellows were making free with the Government reserved lands to fill contracts for railroad ties, and in other ways were doing injury which, it is to be hoped, will now cease. It is not only the Government that must watch timber lands, private companies are forced to keep guards the year round to keep off depredators, but with it all they lose a great deal, owing to the difficulty of distinguishing boundary lines on large tracts, and of claiming stolen timber.—*Timber Trades Journal*, July 5th, 1879.

THE building trade is in a healthy condition with us, and in some sections exceedingly active. This has created a good demand for suitable lumber, and caused a temporary shortness in some kinds, notably hemlock. In all valuable woods there is nearly five per cent. advance over this time a year ago. It would thus seem that it only requires a few favouring circumstances, and a hopeful sentiment to turn the tide that has been so long running out, and bring back prosperous times to the timber trade.—*Ib.*

IF the ship canal across Central America, that has recently occupied the attention of scientific men assembled at Paris, becomes a fixed fact, it will undoubtedly affect the hardwood interests, as it must open up to commerce the immense tracts of forests of Spanish cedar, mahogany, and other valuable trees which now are but little worth, owing to their isolated state. Already some Americans have obtained grants from the Government of Nicaragua, which, if the canal is built, will make them valuable. They have commenced operations in the timber districts, and expect soon to send shipments of Spanish cedar to New York, where it commands a good price. As a financial speculation our capitalists will be slow to take the initiative in building the canal, but will float into the enterprise when they see it is going to be successful. The scheme itself is one that we have fostered and watched for years; and, although our views in regard to the route are different from those of the Congress, we will gladly see any practicable way across opened.—*Ib.*

Coppicing Cinchona Plants.—The Commissioner of the Nilgeris was recently directed to arrange for coppicing experiments at all the Government Cinchona Plantations, and the Conservator of Forests was called upon to advise as to the time of year most favourable for the experiment. In a telegram, dated 18th February 1879, Colonel Beddome states that from May to August are the best months for coppicing, and May is one of the months recommended by the Assistant Superintendent of the Neddiwattam Plantations in his telegram, dated 17th February 1879. The late Mr. McIver reported that trees coppiced between March and August put out healthy shoots; and Mr. Broughton found that the bark contained its maximum of alkaloid in the months of May and October. May would thus seem to be the best month for coppicing the trees. The work will be put in hand accordingly, and special attention will be given to keeping the two operations of barking and felling equally advanced. The Government attach much importance to these coppicing experiments, and they are to be supervised with special care. The immediate superintendence will be undertaken by the Forest Department, Colonel Beddome himself inspecting and advising as to the plots to be felled, and the Deputy Conservator in charge of the Nilgiri Range exercising a general supervision over the whole operations and personally conducting those at Pykara (Wood and Hooker Estates.) The Assistant Superintendent will personally conduct the work on the Neddiwattam Estate with the assistance of a thoroughly competent subordinate, to be furnished by the Forest Department.—*Madras Mail*, May 1st, 1879.

LOCAL GAZETTES have been full of the ground nut (*Arachis hypogæa*)—all having published a Resolution of the Government of India on the subject of what is commonly known in America as the ‘pea nut,’ and if our recollection serves us, as the ‘monkey nut’ of school boys at home. Reading this Circular, one would think that there is nothing like ‘pea nuts’; henceforth famines are at an end, and poverty a thing of the past. Cultivate the pea nut! The gist of the whole Resolution lies in the last paragraph, which is as follows :—

"The question now is whether India should be content to leave France to draw all her supplies of this valuable food-stuff and commercial product from Africa, or whether she should not enter actively into competition for, at any rate, a substantial portion of the trade. The cultivation is no novelty, requiring the removal of prejudices and other obstacles for its introduction. The plant is well-known and appreciated by the people, and in some places the cultivation is already not insignificant, and there is abundant room for development. Cultivators would probably respond without delay or difficulty to any call made upon them for an increased production, but they can hardly be expected to undertake any considerable risk by largely increasing the area under the plant without first having an assured demand for the produce. The increase of the effective demand must depend upon the action of produce merchants at the chief ports of export. The Governor-General in Council has thought it expedient to give publicity to the foregoing details, in case the merchants of Bombay, Madras, and Calcutta should find it to their advantage to enter into relation with the Marseilles houses, who import this staple, or with dealers in the districts where the nut is already a recognised agricultural staple."

WITH reference to the Note at p. 120 of our last number, the following letter was sent from Kew Gardens, with reference to the Wood specimens sent there last year:—

"Referring to your letter of August 23rd of last year, I am desired by Sir Joseph Hooker to state that the collection of forest produce presented to the Museum of Economic Botany of the Royal Gardens by the Government of India, was safely delivered at this establishment at the close of last October.

During the past winter the officers in charge of the museum have been occupied under my supervision in unpacking, examining and incorporating the specimens with our permanent collections. This work is now finished, and Sir Joseph Hooker is able to speak with the highest satisfaction of the efficient manner in which the energy and knowledge of the Indian Forest Department, supported in this matter by the liberality of the Indian Government, has enabled the woody vegetation

of India to be illustrated in our museums in a way which is not paralleled in the case of any other British Possession.

Not the least merit of the collection was the care with which the specimens had been selected and prepared for museum purposes. A large number remained over when the work of incorporation had been completed, and these duplicates have been distributed to Botanical Museums in Berlin, Florence, Lisbon, and Paris, where they have been gratefully accepted.

We find that the reason for the dispersion of the series of specimens of important species was the want of sufficient accommodation. Now that the Indian Museum is to be broken up, it is to be hoped that a larger space will be provided at Kew, but it will then be too late to recover the specimens dispersed, unless, as is probable, a good many are replaced from those sent to the India Museum.

MORE NEW SOUTH AMERICAN TREES TO WORK WONDERS IN INDIA!—The last new thing sent out under the auspices of Dr. Birdwood, who probably thinks that, as we have already got our tea tree and sugarcane, we ought not to be long without our milk plant, is the 'Cow Tree' of Venezuela, '*Brosimum Galactodendron*.' This wonderful tree is to be tried in the Bombay Presidency, but we should think has very little chance of succeeding in the dry climate of the Peninsula.

We hear that the proposed factory for impregnating pine sleepers from the North-West Himalaya with metallic salts, on the subject of which a memorandum was written last year by Dr. H. Warth, is not to be established, as the Railway Companies and State Railway authorities are unanimous against impregnated *Chir*.

Most of the Railway authorities seem to find it cheaper to use creosoted fir from Europe. That that description of sleeper is cheaper is no doubt true, but is anything known of its durability? We have heard talk of creosoted fir sleepers which had scarcely an inch of creosoted wood on the outside, and were evidently meant to undersell indigenous produce in the Indian market.

THE export of all kinds of sawn timber, firewood, and charcoal produced in Cyprus has been forbidden, under penalty of a fine of not more than £100, and confiscation of the produce which it is desired to export.—*Revue des Eaux et Forêts*.

THE Roumanian Forest Administration has advertised for sale the whole of the Forest of Seca de Padure, consisting of 5,500 acres in the arrondissement of Dumbrava.

This forest is in the plains, and offers great facilities for working. It consists of oak of very large size, some over-mature, but all good for making barrel-staves and sleepers. The auction was to take place at Bucharest on the 8th September.—*Id.*

WE hear that several changes in the Madras Forest Department are proposed. From the following extract from the *World* of August 20th, it would seem that Captain Campbell-Walker is to be made Superintendent of the Cinchona Plantations, while in another paper we read that Major R. Jago is talked of in connection with the superintendence of a mule-stud in the Nilgherry hills :—

“The Indian Government has at last determined to appoint a qualified officer to superintend and develop its valuable Cinchona plantations in the Nilgherry hills, and has recommended that the services of Captain Campbell-Walker be utilised for this purpose. Captain Walker’s name is already well known in connection with the Forest Department of India ; and only last year he drew up a special report on this subject, which was very favourably received by the Duke of Buckingham. He has now in the press a valuable book on forestry, based on his official reports on forest management in Germany, Austria, and Great Britain, combined with those of New Zealand and the Cinchona district just referred to. This district covers an area of about three thousand acres ; and the supply of bark for the manufacture of amorphous quinine could be made such as would result in a perceptible decrease in the cost of that at present very expensive medicine.”

THE Secretary of State has, on the recommendation of the Indian Government, granted pensions, aggregating Rs. 100 per mensem, to the family of the late Mr. C. F. Nepean, an Assistant Conservator of Forests in British Burmah, who was murdered by dacoits while in the execution of his duty.

WE hear that the proposal to institute a Pension Fund for the Public Works, Telegraph, and Forest Department, has been negatived.

Y. TIMBER MARKET.

Wholesale Prices, 7th June 1879, from the "Timber
Trades' Journal."

MAHOGANY—			
St. Domingo ...	... per superficial foot	0 0 6 @	0 1 0
Cuba ...	... none „ nominal	0 0 6 „	0 0 8½
Honduras ...	... „	0 0 4 „	0 0 6
Mexican ...	... „	0 0 4 „	0 0 6½
CEDAR—			
Havana, &c. ...	... „	0 0 4½ „	0 0 5½
WALNUT—			
Italian ...	... „	0 0 3 „	0 0 5
SATINWOOD—			
St. Domingo ...	... „	0 0 8 „	0 1 0
ROSEWOOD—			
Rio ...	... nominal	17 0 0 „	20 0 0
Bahia ...	... „	16 0 0 „	18 10 0
LIGNUM VITE—			
St. Domingo ...	... „	3 10 0 „	10 0 0
Bahama, Jamaica, &c. ...	... „	3 0 0 „	6 0 0
GREENHEART—			
Demerara ...	... per load	5 0 0 „	5 10 0
TEAKWOOD—			
East India ...	... „	9 0 0 „	10 0 0

At the "Baltic," on the 11th June, Messrs. CHURCHILL and
SIM, brokers :—

Honduras mahogany, 449 logs, from Belize, sold at 3½d. to
7½d. ; average 4¾d.

St. Domingo mahogany, 88 logs, from Puerto Plata, at 5½d. to
7½d. ; average 6½d.

50 curls ditto, at 30d. to 31d. ; average 30½d.

Honduras cedar, 26 logs, at 4½d. to 5½d. ; average 4¾d.

Surinam cedar, 12 logs, at 4d. ; 5 logs, at 3¾d.

St. Domingo satinwood, 21 logs, at 6d.

American walnutwood, 37 logs, at 4s. to 4s. 9d. per cubic foot :
6 logs at 3s. 9d.

American whitewood, 6 logs, at 2s. 3d. and 2s. 6d.

The following were sold without reserve :—

Green ebony, about 6 tons, at £4 per ton. About 8 tons, at
£3 10s. 22 pieces at £5 15s.

Kaurie pine, 8 logs, at 1s. 10d. to 2s. 3d. per cubic foot.

Rock elm, 104 logs, at 10d. per cubic foot.

Bahama satinwood, 576 pieces, at £5 10s. per ton.

Snakewood, 14 pieces, at £30 10s. per ton.

At the London Commercial Sale Rooms, on the 17th inst.,
Messrs. C. LEARY & Co., brokers :—

Mexican mahogany, 77 logs, from Minatitlan, sold at 4d. to
6d. ; average $4\frac{2}{3}$ d.

Tabasco mahogany, 46 logs, from Santa Ana, sold at $4\frac{1}{2}$ d. to
6d. ; average $5\frac{1}{3}$ d.

At the London Commercial Sale Rooms, on the 24th June,
Messrs. C. LEARY & Co., brokers :—

Mexican mahogany, from Minatitlan, sold at $4\frac{1}{2}$ d.

Tabasco mahogany, 60 logs, from Santa Ana, sold at $4\frac{1}{2}$ d.
to $6\frac{3}{4}$ d.

At the London Commercial Sale Rooms, on the 26th June,
Messrs. THOMAS EDWARDS & SONS, brokers :—

Mexican mahogany, 115 logs (64,943 ft.), from Minatitlan, sold
at $3\frac{3}{4}$ d. to 7d. ; average $4\frac{1}{6}$ d. per foot.

Ditto, 49 logs (20,742 $\frac{1}{2}$ ft.), from Minatitlan, at
 $3\frac{3}{4}$ d. to $4\frac{1}{2}$ d. ; average 4d.

Tabasco mahogany, 34 logs (12,741 ft.), from Tonalá, at $3\frac{3}{4}$ d.
to $5\frac{1}{2}$ d. ; average 4d.

Ditto, 17 logs (10,038 $\frac{1}{2}$ ft.), from Tonalá, at $3\frac{3}{4}$ d.
to $4\frac{1}{2}$ d. ; average $4\frac{1}{2}$ d.

Mexican cedar, 2 logs, (367 ft.), at 4d. average.

MAHOGANY AND HARDWOOD MARKETS.

At the Baltic Sale Rooms, on the 9th July, Messrs. CHURCHILL & SIM, brokers :—

Honduras mahogany, 289 logs, from Belize, sold at $3\frac{1}{2}$ d. to $11\frac{1}{2}$ d.; average $4\frac{1}{2}$ d.

Ditto cedar, 44 logs, at $4\frac{1}{2}$ d. to $6\frac{1}{2}$ d.; average $4\frac{1}{8}$ d.

St. Domingo mahogany, 65 logs, from Puerto Plata, at 6d. to $7\frac{1}{2}$ d.; average $6\frac{3}{4}$ d.: 2 logs, at $7\frac{1}{2}$ d.: 3 logs, at $6\frac{1}{2}$ d.

Surinam cedar, 7 logs, at $3\frac{1}{2}$ d.

Black Sea walnutwood, 27 logs, from Poti, at $5\frac{1}{2}$ d. to 6d.

Italian walnutwood, 540 planks, from Genoa, chiefly at 4d. to $4\frac{1}{2}$ d.; one lot at $5\frac{1}{2}$ d.

American whitewood, 3 logs, at 19d. per cubic foot (without reserve).: 3 logs, at 19d.

East India ebony, 2 logs, at £15 10s. per ton.

East India rosewood, 2 logs, at £10 10s. per ton.

Bahama satinwood, one lot of 496 pieces, sold at £5 5s., and one of 228 pieces at £9 15s. per ton.

Persian boxwood, 94 pieces, at £5 per ton.

At the London Commercial Sale Rooms, on the 10th July, Messrs. THOMAS EDWARDS & SONS, brokers :—

Tabasco mahogany, 194 logs (87,376 ft.), from Tonala, sold at $3\frac{1}{2}$ d. to $9\frac{1}{2}$ d.; average $4\frac{1}{8}$ d. fully.

Ditto cedar, 1 log (188½ ft.), ditto, at $3\frac{1}{2}$ d.

At the Commercial Sale Rooms, on the 15th July, Messrs. C. LEARY & Co., brokers :—

Tabasco mahogany, of 129 logs, from Santa Ana, part sold at $4\frac{1}{2}$ d. to 12d.

Part of 146 logs, from Santa Ana, sold at $4\frac{1}{2}$ d. to 6d.

Following the above sale on the same date Messrs. SHADBOLT and SON, brokers :—

Mexican mahogany, 191 logs, from Tlacotalpam, sold at $3\frac{1}{2}$ d. to 6d.

Ditto, cedar ditto, of 100 logs, part sold at $4\frac{1}{2}$ d.

Honduras mahogany, 240 logs, from Belize, sold at $3\frac{1}{2}$ d. to 6d.

Italian walnutwood, 1,500 planks, at 4d. to $4\frac{1}{2}$ d.

At the Commercial Sale Rooms on the 24th inst., Messrs. THOMAS EDWARDS & SONS, brokers:—

Mexican mahogany, 324 logs (115,373 ft.), from Minatitlan, sold at $3\frac{1}{2}$ d. to $4\frac{3}{4}$ d.; average $3\frac{3}{4}$ d.

Honduras mahogany, 34 logs (14,415½ ft.), from Belize, sold at $3\frac{3}{4}$ d. to $5\frac{1}{4}$ d.; average $4\frac{1}{3}\frac{1}{4}$ d.

At the Commercial Sale Rooms, on the 29th inst., Messrs. G. SHADBOLT & SON, brokers:—

Honduras mahogany, 539 logs, chiefly at $3\frac{1}{2}$ d. to $6\frac{1}{2}$ d.

Honduras cedar, 367 logs, at 4d. to $7\frac{3}{4}$ d.; curls at $3\frac{1}{2}$ d.

Satinwood, 13 logs at $3\frac{1}{2}$ d. to $3\frac{3}{4}$ d.

Cuba mahogany, 7 logs at $5\frac{1}{2}$ d.

Italian walnutwood, 360 planks at 4d.

At the Baltic Sale Rooms on the 30th inst., Messrs. CHURCHILL & SIM, brokers:—

Honduras mahogany, 355 logs, from Belize, sold at $3\frac{1}{2}$ d. to $15\frac{1}{2}$ d.; average $4\frac{2}{3}\frac{2}{3}$ d.

Honduras cedar, 79 logs, $4\frac{1}{2}$ d. to $4\frac{3}{4}$ d.; average $4\frac{1}{2}$ fully.

Cuba mahogany, 2 logs, at 20d. to 21d. respectively; 19 curls at 10d.

Black Sea walnutwood, 11 logs, from Poti, at 6d. to $6\frac{1}{2}$ d.

St. Domingo mahogany, 2 logs, at 6d.

Italian walnutwood, from Genoa, at $4\frac{3}{4}$ d.

(The following without reserve.)

Granadille wood, 60s. to 90s. per ton.

American whitewood, from New York, at 15d.

Dominica satinwood, £7-5s. per ton.

Green ebony, from Jamaica, 55s. per ton.

LIVERPOOL MAHOGANY, &C., SALES.

On the 20th June Messrs. Edward Chaloner & Co. held one of their periodical auction sales, which was well attended, and good prices obtained for wood when of fair to prime quality.

The cargo of Honduras mahogany from Porto Cortes, 345 logs, sold at 4d. to $12\frac{1}{2}$ d., averaging $6\frac{3}{4}$ d. per foot; several parcels of City St. Domingo mahogany also met with fair sales; 96 logs at 5d. to 3s. 7d., averaging $7\frac{9}{16}$ d., and 12 logs at $6\frac{1}{2}$ d.

to 2s. 5d. per foot; 102 curls at 1s. 2d. to 2s. 7d., and 15 curls at 1s. 7d. to 2s. 5d. Honduras cedar, 69 logs, sold at from 4½d. to 8½d., averaging 5¾d., and 2 logs City St. Domingo satinwood at 2s. 8d. per foot. Two parcels of American black walnutwood sold at from 4s. 4d. to 5s. 8d., averaging 5s. per foot, and 51 planks Bahia rosewood at from £14 10s. to £26, averaging £17 4s. per ton.

On Wednesday, the 2nd July, Messrs. Farnworth and Jardine offered a cargo of Mexican mahogany and several parcels of walnut and other fancy wood. The attendance of buyers was only moderate, yet a good quantity of wood changed hands, the entire cargo of Mexican mahogany being sold at from 4d. to 9d., averaging 5½d. per foot, and the balance of the cargo of Tabasco mahogany from Tonala, at from 4½d. to 5½d., averaging 4½d. per foot. Black walnutwood (7 logs) sold at 5s. 3d. per cubic foot.

STOCK OF WOOD AT THE LONDON DOCKS.

FURNITURE, &C., WOODS.

Mahogany, W. I. and Spanish	...	...	Logs	530	2,234
" Honduras	...	...	"	2,538	2,219
" Mexican	...	...	"	2,850	6,147
" Cuba	...	...	"	178	717
" African	...	...	"	11	11
Satinwood, St. Domingo	...	...	Tons	364	245
" Bahama	...	...	"	40	70
" Other countries	...	...	"	878	1,381
Rosewood	...	...	Planks	582	1,419
Zebra	...	...	"	142	167
Cedar, Mexico	...	...	Logs	18	23
" Cuba	...	...	"	—	6
" Honduras	...	...	"	238	165
" New South Wales	...	...	"	—	—
" Pencil	...	...	"	1,210	2,405
" Other countries	...	...	"	559	223
Ebony, East India	...	...	Tons	886	905
" Green W. I.	...	...	"	192	305
" Cocus	...	...	"	149	133
" African	...	...	"	870	968
Lignum vitæ	...	...	"	373	652
Boxwood	...	...	"	127	327

YJ. EXTRACTS FROM OFFICIAL GAZETTES.

1.—GAZETTE OF INDIA.—

No. 574F.—*3rd July 1879.*—*Mr. E. F. Litchfield*, Officiating Assistant Conservator of Forests of the 3rd Grade, attached to the Forest Survey Branch, is granted privilege leave of absence for one month, with effect from the 25th June 1879, or any subsequent date on which he may avail himself of it.

No. 576F.—*3rd July 1879.*—*Mr. A. L. Home*, Deputy Conservator of Forests of the 2nd Grade, is appointed to officiate in the 1st Grade, with effect from the 21st February 1879, as a temporary measure, while holding the post of Assistant Comptroller General (Forests).

No. 578F.—*3rd July 1879.*—*Messrs. R. H. M. Ellis and G. G. Minniken*, Assistant Conservators of Forests of the 1st Grade in the Punjab, are appointed to officiate as Deputy Conservators of the 3rd Grade, with effect from the 24th May and 1st June 1879, respectively.

Mr. W. Johnstone, L.C.E., Assistant Conservator of Forests of the 2nd Grade in Bengal, is appointed to officiate as an Assistant Conservator of the 1st Grade, with effect from the 24th May 1879.

No. 595F.—*11th July 1879.*—*Mr. J. S. Battie*, Forest Ranger of the 6th Grade in Oudh, is appointed to officiate as a Sub-Assistant Conservator of Forests, with effect from the 24th May 1879.

Mr. Battie will remain attached to the North-Western Provinces and Oudh.

No. 598F.—*12th July 1879.*—The following promotions are made in the Forest Department of British Burmah, with effect from the 25th December 1878 :—

Mr. J. W. Oliver, officiating as an Assistant Conservator

of the 1st Grade, is confirmed in that grade, and will continue to officiate as a Deputy Conservator of the 3rd Grade.

Mr. C. W. Palmer, Sub-Assistant Conservator of Forests, is promoted to be an Assistant Conservator of Forests of the 3rd Grade.

Mr. H. B. Ward, Sub-Assistant Conservator of Forests, is promoted to officiate as an Assistant Conservator of Forests of the 3rd Grade.

No. 608F.—17th July 1879.—*Mr. J. C. Murray*, Officiating Sub-Assistant Conservator of Forests, attached to the Forest Survey Branch, is transferred to the North-Western Provinces for employment in the Forest School Circle.

No. 621F.—19th July 1879.—*Mr. C. Bagshawe*, Deputy Conservator of Forests of the 3rd Grade in the North-Western Provinces, is placed at the disposal of the Military Department for employment in the forests of the Kuram Valley, and, while thus employed, will officiate in the 2nd Grade of Deputy Conservators, with effect from the date of reaching Kuram.

No. 632F.—23rd July 1879.—The furlough granted in Notification of the Department of Revenue, Agriculture and Commerce, No. 462F., dated the 29th May 1879, to *Mr. A. T. Drysdale*, Deputy Conservator of Forests, Hyderabad Assigned Districts, is cancelled at his own request.

No. 673F.—12th August 1879.—*Mr. G. Greig*, Conservator of Forests of the Central Circle in the North-Western Provinces and Oudh, is appointed, in addition to his own duties, to act as Conservator of Forests of the Oudh Circle, during the absence of *Captain E. S. Wood* on three months' privilege leave.

No. 693F.—21st August 1879.—*Mr. R. H. C. Whittall*, Deputy Conservator of Forests of the 3rd Grade, in British Burmah, officiated as Conservator of Forests of the Pegu Circle from the 12th May to the 30th June 1879, on which date *Major Seaton* assumed charge

of the Pegu Conservatorship in addition to his own duties.

No. 766F.—22nd September 1879.—The Governor-General in Council is pleased to make the following promotions in the Forest Department:—

Mr. R. S. Dodsworth, Assistant Conservator of Forests of the 1st Grade in the North-Western Provinces and Oudh, and at present on leave, is promoted to the 3rd Grade of Deputy Conservators, with effect from the 29th May 1879.

Mr. E. P. Dansey, officiating as an Assistant Conservator of Forests of the 1st Grade in the North-Western Provinces and Oudh, is confirmed in that Grade, with effect from the 29th May 1879.

Mr. C. E. Fendall, Sub-Assistant Conservator of Forests, and officiating as an Assistant Conservator of Forests of the 3rd Grade in the Punjab, is confirmed in that Grade, with effect from the 29th May 1879.

Mr. A. Stewart, Sub-Assistant Conservator of Forests, and officiating as an Assistant Conservator of Forests of the 3rd Grade in Berar, is confirmed in that Grade, with effect from the 15th June 1879.

Mr. A. Campbell, officiating as a Sub-Assistant Conservator of Forests in the North-Western Provinces and Oudh, is confirmed in his appointment, with effect from the 29th May 1879.

Mr. D. P. Copeland, officiating as a Sub-Assistant Conservator of Forests in Assam, is confirmed in his appointment, with effect from the 15th June 1879.

Mr. W. H. Reynolds, Assistant Conservator of Forests of the 1st Grade, and Deputy Superintendent of Forest Surveys, is appointed to officiate as a Deputy Conservator of Forests of the 3rd Grade, with effect from the 29th May 1879.

2.—CALCUTTA GAZETTE.—

25th June 1879.—Under section 71 of the Indian Forest Act, VII of 1878, the Deputy Conservator of Forests in the

Sunderbuns Division is vested with the powers specified in clauses C. and D of that section.

1st July 1879.—*Mr. F. B. Manson*, Assistant Conservator of Forests, Kurseong Division, is appointed, in addition to his own duties, to have temporary charge of the Julpigoree Forest Division, *vice* Mr. H. R. Ring, deceased.

15th July 1879.—*Mr. E. Fuchs*, Assistant Conservator of Forests, in charge of the Teesta Division, is allowed leave for two months and twelve days, under sections 41 and 42 of the Civil Leave Code, with effect from the 10th instant.

The 28th July 1879.—The following rules, passed by the Lieutenant-Governor of Bengal, under section 25 (i) of the Indian Forest Act, VII of 1878, are hereby published for general information. They will take effect in all reserved Forests in Bengal, and will come into force from the 1st September 1879.

Rule I.—No person shall, unless it be necessary in defence of the life or limb of himself or some other, kill or wound any elephant, or catch or attempt to catch elephants in any part of a reserved Forest.

Rule II.—No person shall set snares or traps in any reserved Forest.

Rule III.—The Forest Officer may, with the sanction of the Local Government, close any reserved Forest, or any part of such forest, against hunting, shooting, or fishing.

Rule IV.—Nothing in Rules I to III shall be deemed to prohibit any act done with the permission in writing of the Forest Officer or of the Local Government.

The 28th July 1879.—Under sections 2 and 75 (a) of Act VII of 1878 (the Indian Forest Act), the Lieutenant-Governor is pleased to direct that the officers of the Forest Department in Bengal, mentioned in the first column of the following schedule, shall exercise the powers of "Forest officers" under the sections of the Forest Act mentioned in the second column of the same, over against each such class of officers respectively :—

Class of officers empowered.	Section of the Act under which powers are given.	Brief description of nature of powers conferred.
I.—All Deputy Conservators, Assistant Conservators, and Sub-Assistant Conservators, when in charge of Forest Divisions.	20	Power to publish translation of notification of reserved forests.
	25	Power to permit prohibited acts in reserved forests.
	33	Power to permit prohibited acts in protected forests.
	45	Power to notify depôts for drift timber, &c.
	46	Power to issue notice to claimants of drift timber, &c.
	47	Power to decide claims to drift timber, &c.
	50	Power to receive payments on account of drift timber, &c.
	60	Power to direct release of property seized.
	67	Power to compound offences.
	82	Power to sell forest produce for Government dues.
II.—All Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, Rangers and Foresters subordinate to any officer of Class I, when specially authorized in that behalf by the Conservator of Forests.	25	Power to permit prohibited acts in reserved forests.
	33	Power to permit prohibited acts in protected forests.
	60	Power to direct release of property seized.
	67	Power to compound offences.
III.—All Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, Foresters, Rangers and Forest Guards, whether on permanent or temporary establishments.	45	Power of collecting drift timber, &c.
	52	Power to seize property liable to confiscation.
	55	Power to take charge of Government or confiscated property.
	56	Power to accept charge of property when offender is unknown.
	63	Power to arrest without warrant in certain cases.
	69	Power to seize and impound cattle trespassing.
	82	Power to take possession of produce under Government lien.

The 7th August 1879.—The following rules regarding the examination of Forest officers in the provinces under the Lieutenant-Governor of Bengal are, with the sanction of the Government of India, published for general information:—

The officers of the Forest Department in Bengal will be required to pass by the same standards of examination (Higher and Lower) in Bengali and Hindustani as are prescribed for police officers.

The examinations will be conducted under the orders of the Central Examination Committee, Calcutta, at the several local centres, as provided for in the examination rules of the 21st

November 1874. Special papers will, however, be prepared for Forest officers in which technical judicial terms will be avoided, and such terms substituted as bear directly on Forest work.

A Forest officer passing the above examinations will be considered to have fulfilled the conditions as regards examination in languages laid down in rules 17 and 18 of the Forest Department Code for the purpose of promotion to higher grades. The examinations passed by Forest officers in Hindustani by the military standard in the other provinces or in Bengal previous to the issue of these orders will, however, hold good for purposes of promotion.

11th August 1879.—In continuation of the orders of the 29th April 1879, appointing *Mr. R. N. Anstruther*, Assistant Conservator of Forests, until further orders, to have charge of the Palamow Forest Division, *Mr. W. Johnston*, Assistant Conservator of Forests, is appointed to take charge of that Division. *Mr. Anstruther* will, however, remain attached to it until further orders.

Mr. W. Johnston is also appointed to the charge of the Hazareebagh Forest Division.

25th August 1879.—The two months' privilege leave granted to *Mr. W. M. Green*, Officiating Assistant Conservator of Forests, Chittagong Division, under orders of the 17th June last, is commuted to four months' leave on medical certificate, under section 4, supplement F., to the Civil Leave Code.

9th September 1879.—In addition to the revenue stations, of which a list was published in the *Calcutta Gazette* of the 23rd April 1879, Samukpatha, situated on Tolly's Nullah, is hereby notified to be a revenue station of the Sunderbuns Protected Forests.

1st October 1879.—*Mr. W. M. Green*, Officiating Assistant Conservator of Forests, is transferred from the Chittagong division to the charge of the Julpigoree division, with effect from the date on which the leave granted to him under orders, dated the 25th August 1879, expires.

Mr. L. C. Smith, Officiating Sub-Assistant Conservator of Forests, Darjeeling division, is appointed to take charge temporarily of the Teesta Forest Division, during the absence on leave of *Mr. E. Fuchs*, or until further orders, with effect from the afternoon of the 10th July 1879

3.—NORTH WESTERN PROVINCES AND OUDH GAZETTE.—

No. 734.—*24th July 1879.*—*Captain E. S. Wood*, Conservator of Forests, Oudh Circle, three months' privilege leave from the 23rd August 1879, or subsequent date.

No. 871.—*22nd August 1879.*—With reference to Government of India, Home, Revenue, and Agricultural Department Notification No. 621F., dated the 19th July 1879, *Mr. C. Bagshawe*, Deputy Conservator of Forests, made over charge of the Jaunsar Forest Division to *Mr. Rind* on the afternoon of the 26th July 1879, and reported his departure on the forenoon of the 9th August from Dehra Dún, *en route* to join his appointment in the Kuram Valley.

No. 890.—*26th August 1879.*—*Mr. J. C. Murray*, Officiating Sub-Assistant Conservator of Forests, whose services have been placed at the disposal of this Government by the Government of India, to the Jaunsar Forest Division, with effect from 1st August 1879.

No. 957.—*8th September 1879.*—*Babu Kanhaya Lal* to be Superintendent of the Babramghat Timber Depôt, as a temporary measure, with effect from 1st July 1879.

No. 967.—*9th September 1879.*—*Mr. G. Greig* assumed charge of the Oudh Circle from *Captain E. S. Wood* on the afternoon of the 27th August 1879.

No. 979.—*15th September 1879.*—*Mr. J. M. Braidwood*, Assistant Conservator in charge of the Naini Tal Division, one month's privilege leave from 1st September 1879, or subsequent date.

No. 1549.—*29th September 1879.*—The undermentioned Magistrates of the 1st class are hereby empowered to try Forest offences summarily under section 65 of Act VII of 1878 :—

Colonel G. Wheeler, Cantonment Magistrate, Chakrata.

Mr. W. Holmes, Assistant Superintendent, Dehra Dún.

Mr. R. G. Hardy, Officiating Joint Magistrate, Pilibhit, district Bareilly.

Mr. W. Crooke, Officiating Joint Magistrate, Gorakhpur.

Mr. H. Fraser, Assistant Magistrate (Kasia), Gorakhpur.

Mr. J. Deas, Assistant Commissioner, Jhānsi.

Mr. L. Taylor, Officiating Assistant Commissioner, Naini Tal.

Major A. Murray, on return to his duties as Assistant Commissioner, Kheri.

Mr. H. B. Jones-Bateman, Assistant Commissioner.

Mr. H. C. Irwin, Assistant Commissioner, Bahraich.

Mr. J. Hooper, Assistant Commissioner, Gonda.

Mr. K. M. Nicholson, Extra Assistant Commissioner, Gonda.

No. 1032.—30th September 1879.—*Mr. J. M. Braidwood*, Assistant Conservator, availed himself on the afternoon of the 1st September 1879, of the leave granted to him in this Department notification, No. 979, dated 15th idem, making over charge of the Naini Tal Division to *Captain Campbell*.

4—PUNJAB GAZETTE.—

No. 340 F.—19th August 1879.—*Notification*.—In exercise of the powers conferred on him by section 41 of Act VII. of 1878, the Hon'ble the Lieutenant-Governor is pleased to make, and, with the sanction of the Governor-General in Council, hereby to publish the following Rules:—

Punjab River Rules.

Rule I.—All words used in these Rules and defined in Act VII. of 1878, (The Indian Forest Act), shall be deemed to have the meanings respectively attributed to them by the said Act.

Interpretation-clause.

Collection of timber placed in the river from the forest.

Rule II.—No person having launched his timber, or set it afloat on any river, shall collect the same, except—

(a) with the permission in writing of the Forest Officer in charge of the Forest Division;

(b) at the places which such officer may publicly notify as places at which such collection shall ordinarily be made.

Rule III.—No person shall raft, or otherwise convey, any timber which has been collected on any river, without first obtaining a pass from the Forest Officer in charge of the Forest Division in which such river is situate, or from such subordinate Forest Officer as the Officer in charge of the Division may authorize in that behalf.

Such pass shall show the number of logs or pieces, the kind of timber, the marks indicative of the owner's property therein, the place of its destination, and the time for which it shall remain in force. It may

Pass to be obtained for rafting timber after collection.

What the pass contains.

specify that the timber may be stopped for examination at certain places to be named in the pass, and the Forest Officer may require the measurements of the timber (when such is practicable) and its estimated value to be entered.

No pass shall be issued for any unmarked timber, or for such timber as bears a mark not registered as hereinafter provided:

Provided, that when any person having timber in transit on a river, at the date of the publication of these rules, applies for a pass for such timber within six months from such date, such pass may be granted, though the marks on such timber have not been registered.

Any Forest Officer may require any person rafting or conveying timber, as aforesaid, to produce the pass for the same at any time. No person shall be entitled to raft or convey timber by virtue of a pass which he does not himself hold, but which is, or is stated to be, in the hands of some other person.

In the event of the pass not being produced, the Forest Officer may detain the timber.

Rule IV.—No person is permitted to deposit any timber, for Timber not to be deposited close to the water. which a pass has been applied for, but not yet issued, so close to the water's edge as to endanger its being carried away by a rise in the river before the pass is issued.

Rule V.—For the issue of the pass a fee not exceeding one Fee chargeable for the issue of the pass. anna for each log or piece of timber may be levied on such rivers and at such places as the Conservator of Forests may from time to time direct.

Rule VI.—No person shall, without the permission in writing Moving, marking, &c., of the Forest Officer in charge of the Division, cut up, move, conceal, mark or efface or alter any marks on any timber while in transit or adrift on any river, or stranded on any bank or island of the same.

Any such permission, if granted, shall specify the place at which only it is to take effect, and may contain such other conditions regarding the previous inspection of the timber and otherwise as may be necessary.

Rule VII.—All persons wishing to float or otherwise convey timber by any river shall register, at the Forest Office of the Division to which the control of the river pertains, the mark or marks which indicate their proprietary right in such timber. A registration fee of five rupees shall be payable for every separate mark so registered; and if the number of marks exceed three, the said fee shall be ten rupees for each mark.

Rule VIII.—In the case of persons having, at the date of the publication of these rules, timber in transit on any river, a period of six months from such date shall be allowed within which the timber marks existing at such date on such timber in transit may be registered.

Subject only to the provisions of Rule X., the Forest Officer shall during such period be bound to register all such marks as owners of timber can show to his satisfaction to have been already

made use of and put on their timber previously to the publication of these rules; but no such owner shall be entitled to register any new or additional marks without the special permission of the Forest Officer.

Rule IX.—In the case of persons not having, at the date of the publication of these rules, timber or other forest produce in transit on any river marked with several different marks, the registration of one mark only shall be permitted, unless permission be given for any special reason to register more than one.

Rule X.—No person shall be allowed to register a mark already registered in favour of another person, nor any mark used by Government; and the Forest Officer may refuse registration of any mark which in his judgment so closely resembles a mark used by Government; or registered in favour of any person, as to be easily producible by altering such marks.

Rule XI.—Every registration under these rules shall hold good for three years, following the 1st January next, after the date of registration.

A certificate showing the marks registered, the date of registration, the period for which it holds good, and acknowledging the payment of the fees, shall be given to every person registering his mark or marks.

Rule XII.—Any person infringing any provision of these rules shall be punished with imprisonment of either description, which may extend to six months, or with fine which may extend to five hundred rupees, or with both.

No. 341F.—19th August 1879.—*Notification.*—In exercise of the powers conferred on him by section 51 of Act VII. of 1878, the Hon'ble the Lieutenant-Governor is pleased to make and hereby to publish the following Rules:—

Rule I.—Whenever on any river, owing to flood or otherwise, timber has passed the place or all the places where it would ordinarily be caught and brought under control, or has, after being brought under control, broken loose, and is consequently adrift or stranded below, the Forest Officer in charge of the Forest Division in which such river is situate may, instead of collecting such timber himself, under section 45 of Act VII. of 1878, grant permission in writing to the owner or owners to collect such timber.

Rule II.—The permission shall specify the kind of timber, the marks it should bear, the destination or manner of its disposal when collected, and the time for which such permission shall hold good.

Rule III.—No person shall without such permission cut up, remove, conceal, burn, mark or efface, or alter any mark or marks on, or sell or otherwise dispose of any such timber.

Rule IV.—The Forest Officer in charge of the Division may

authorize zaildars, lambardars, or other respectable persons to salve timber which is adrift at any point on the river below the last catching place, and may cancel such authority.

For every log salvaged and taken to any drift timber depôt notified by the Forest Officer under section 45 of the Act, the following salvage rates shall be payable, either to the authorized salvager or to the Forest Officer, as the case may be :—

For every log of deodar of 8 feet in girth and over—1 rupee.			
Ditto	5	ditto	... 8 annas.
Ditto	under 5	ditto	... 3 annas.
Sleepers and scantlings			... 3 annas each.

For logs and scantlings of other woods, half the above rates.

For salvage of scraps or firewood, one-fourth of the pieces collected in kind.

The Forest Officer in charge may fix any higher rate, not exceeding twice the above rates, for salving on any portion of the river where such salving is unusually difficult or dangerous.

Nothing in this rule shall be held to prevent the Forest Officer contracting with such salvagers to raft the timber at certain places at rates agreed on by the parties, and no salvage rate shall be claimable in addition to any rate paid under such contract.

Rule V.—The collection or salving of timber adrift or stranded below all the catching places by unauthorized persons is prohibited.

Rule VI.—Whoever infringes any provision of the above rules shall be punished for every such offence with imprisonment for a term which may extend to six months, or with fine which may extend to five hundred rupees, or with both.

No. 362F.—15th September 1879.—*Notification.*—*Mr. E.*

McA. Moir, Officiating Deputy Conservator of Forests, reported his departure from Calcutta on the 1st April 1879, on the furlough to Europe granted to him in Government of India, Revenue, Agriculture and Commerce Department Notification No. 279F., dated 13th March 1879.

No. 367F.—20th September 1879.—*Notification.*—*Lieutenant-Colonel W. Stenhouse*, Deputy Conservator of

Forests, Bías Division, having reported his return to duty on the forenoon of the 30th June 1879, the unexpired portion of the privilege leave of absence granted to him in *Punjab Government Gazette* Notification No. 177 F., dated 19th April 1879, is hereby cancelled.

No. 219C.—25th September 1879.—The Lieutenant-

Governor of the Punjab hereby declares that it is proposed to constitute as reserved forest the lands specified in the following table :—

The Deputy Commissioner of Montgomery for the time being

is appointed the Forest Settlement Officer to enquire into and determine the existence, nature and extent of any right alleged to exist within such limits, and to deal with the same as provided in Chapter II. of Act VII. of 1878.

District.	Pargana or other Sub-Division.	Serial Number.	NAMES OF FORESTS.	Boundaries.	REMARKS.
MONTGOMERY.	MONTGOMERY TANKS.	1	Hanjit Singh ...	<p><i>North.</i>—Government waste land bordering on road from Kamaha to Shorkot.</p> <p><i>South.</i>—Government waste land bordering on Pathu-hal and Lal-Issu and Sahibwala wells.</p> <p><i>East.</i>—Government waste land bordering on lands of Kamaha and Shahidanwala.</p> <p><i>West.</i>—Government waste land bordering on wells Swar Shah and Mahulwala.</p>	Area about 7,198 acres. A forest tract, formerly strictly preserved in the Mahārāja's time.
		2	Darsana ...	<p><i>North.</i>—By Government waste land.</p> <p><i>South.</i>—By Government waste land.</p> <p><i>East.</i>—By Government waste land bordering on village land of Sabitwala well.</p> <p><i>West.</i>—By Government waste land.</p>	Area 1,600 acres. The lands of wells Jhuji, Miruwala and Sabitwala lie close to the west, north and east boundary. The west, north and south boundaries are indicated by a narrow line and marks on trees.
		3	Kalera ...	<p><i>North.</i>—By strip of Government waste bordering on village lands Chidhar, Kaba, and Mamdana.</p> <p><i>South.</i>—Ravi river and strip of Government waste bordering on village Kalera and Government waste land.</p> <p><i>East.</i>—Government waste bordering on village lands Jallār-Sugla, Patānah and Changi.</p> <p><i>West.</i>—Road from Chichawetn to Kamaha.</p>	Area 8,825 acres. Rakh No. 58. Formerly north, east and south boundaries indicated by 20 feet line.
		4	Harepps	<p><i>North.</i>—By village lands, Machiwala, Maktwala, Kundwala, Jindwala and Pipalwala.</p> <p><i>South.</i>—By Government waste land.</p> <p><i>East.</i>—By Government waste land.</p> <p><i>West.</i>—By village land Ghanee Lal.</p>	Area 1,727 acres, out of Rakh 18. The village lands mentioned in column 5 lie close to the boundaries, which are marked by a narrow line and notches on trees.

District.	Pargana or other Sub-Division.	Serial Number.	NAME OF FOREST.	Boundaries.	REMARKS.
MONTGOMERY.-(Continued.)	MONTGOMERY TAHLIL.-(Continued.)	5	Dād Fatāna ...	<i>North</i> .—Chah Rajabwāla and Gobanwāla. <i>South</i> .—Strip of Government waste bordering lands of Duda Sahu and lands of Dād Fatāna. <i>East</i> .—Road from Harappa to Kamālia. <i>West</i> .—Strip of Government waste bordering land of village Chankaudi.	Area 1,088 acres, out of Rakh 27. The lands noted in column 5 all lie very close to boundaries.
		6	Mirdād ...	<i>North</i> .—Government waste bordering on village land Bhalānwāla, Dasavanwāla, Māchiwāla, Mirdād, Karm Elāhi, Naorangwāla and Fatauwāla. <i>South</i> .—Government waste land and small portion of Mooltan and Lahore road. <i>East</i> .—Government waste land and well Jamanwāla. <i>West</i> .—Strip of Government waste bordering on land of Harappa.	Area 3,319 acres. Well Kaganwāla is in the centre of the area. The west, north and east boundaries are indicated by 20 feet line, while the south one is shown by a narrow one.
		7	Muhammadpur	<i>North</i> .—By Government waste land. <i>South</i> .—Road from Mooltan to Lahore. <i>East</i> .—Government waste land. <i>West</i> .—Government waste land bordering on Muhammadpur.	Area 1,536 acres. All the boundaries are indicated by 20 feet line. The lands of Muhammadpur on west, Bakianwāla on north, and Mohabatwāla, Ahmedwāla and Chakianwāla on the east are very near.
		8	Montgomery ...	<i>North</i> .—By Government waste land. <i>South</i> .—By Government waste land. <i>East</i> .—By Government waste land bordering on west of road from Montgomery to Lahore and Mooltan road. <i>West</i> .—By Government waste land.	Area 4,319 acres. The lands of Ahmedwāla Sarkanawāla and Fakiranwāla approach the north boundary.
		9	Alhwāl ...	Government waste land on all sides.	
		10	Nūr Shah ...	<i>North</i> .—Government waste land. <i>South</i> .—Government waste land. <i>East</i> .—Government waste land. <i>West</i> .—Government waste land and village land of Karelawāla.	Area 3,440 acres. The west, south and portion of north boundary is indicated by a 40 feet line, and the remainder by a 10 feet one. The lands of Karam Elāhi and Karelawāla lie on the west, and of Shah Muhammad on the north.

District.	Parganas or other Sub-Division.	Serial Number.	NAMES OF FORESTS.	Boundaries.	REMARKS.
MONTGOMERY. — (Continued.)	MONTGOMERY TANKS. — (Continued.)	11	Burj Jawa Khan	North.—Government waste land. South.—Government waste land. East.—Government waste land bordering on village land of Retri and Mouj Daryai wala. West.—Government waste land.	Area 4,373 acres. The lands of Khan Kamaal and Amir Singh He on the west, and those of Retri and Mouj Daryai on the east. The north boundary touches the Mooltan and Lahore road at one point.
		12	Gashkori	North.—Government waste land bordering on village land of Gashkori. South.—Government waste land. East.—Government waste land. West.—Government waste land and road from Pakpatian to Gugera.	Area 4,048 acres. Gashkori wala lies on north, and Mauwala on south-east. The north and east boundaries are indicated by a 10 feet line, and the south by a foot one.
		13	Gugera	North.—Strip of Government waste bordering on Ram-nuash and Dardawar and Mooltan and Lahore main road. South.—Government waste land. East.—Government waste land. West.—Road from Okara to Gugera, and Government waste land.	Area 2,211 acres. Includes portion of well "Rudh Jalalao" on south-west.
		14	Okara	North.—Government waste land. South.—Government waste land. East.—Road from Okara to Gugera and strip of Government waste land. West.—Government waste land.	Area 4,254 acres. Well Channu is close to north boundary and piece of private land. "Wan Hiram-tam" is included on south. The west and north boundary cleared for 10 feet.
		15	Baggiana	North.—Government waste land. South.—Government waste land. East.—Strip of Government waste bordering on village land of Baggiana. West.—Government waste land.	Area 1,408 acres. The lands of Baggiana lie contiguous to the east boundary of this forest. Most of the east boundary is cleared to a width of 20 feet.
	GUGERA TANKS.	16	Bibipur	North.—Strip of Government waste land bordering on Bibipur. South.—Government waste land. East.—Government waste land. West.—Strip of Government waste land bordering on Baggiana.	Area 808 acres. The lands of Baggiana on the west, Bibipur on north, and Satghara on the east. The east boundary touches the Satghara and Okara road at one point.

District.	Fargana or other Sub-Division.	Serial Number.	NAME OF FOREST.	Boundaries.	Remarks.
MONTGOMERY. — (Concluded)	GUGRA TARSIL — (Concluded)	17	Satghara ...	Government rakh land on all sides.	Area 2,055 acres. Includes well Jāwāla Mahoi. Lands of well Mobarikwala and Batahwala is close on north and south boundary respectively.
		18	Chokian ...	Government rakh land on all sides.	Area 1,579 acres. Lands of Kalipur lie near west boundary and those of Chokian and Dhalarna on north-east and east. The boundary on north-east face is indicated by 20 feet line.
		19	Kola ...	North.—Mooltan and Lahore road. South.—Government waste land. East.—Government waste land. West.—Government waste land.	Area 1,114 acres. Lands of Nawalpur and Jaganwala lie near west, those of Sardariwala on north, and of Kalpur on south. The north boundary touches the Lahore and Mooltan road at two points, and that on the north-east and south-west faces is cleared to a width of 20 feet.
		20	Kamman ...	North.—Government wastes lands of Thathi Kalasan, and road from Chuchak to Wan Badha ham station. South.—Government waste land. East.—Government waste land and well Koda Maile, Turanwala and Shalaba'wala. West.—Strip of Government waste bordering on village land of Kamman, Mithabatti and Kānuwala.	Area 2,490 acres. The lands of villages named in boundary column lie close, and those of Islampur approach on south. All but about 2 miles new of the boundaries cleared 20 feet and the 2 miles 10 feet.
		21	Syadwala ..	North. The Deg Nalla South.—By an irregular line partly following the road from Syadwala to Sharakpur. East.—By the Lahore District. West.—By Government waste land.	Known as old rakh No. 25 near Syadwala.

5.—CENTRAL PROVINCES GAZETTE.—

No. 2778.—3rd July 1879.—*Mr. H. Leeds*, Deputy Conservator of Forests, returned from the privilege leave granted to him by Notification No. 1327, dated 19th March last, and resumed charge of his duties on the 17th ultimo, after noon.

No. 3235.—*1st August 1879.*—Two months' examination leave, under paragraph 22 of the Forest Code, is granted to *Mr. E. Ludlow*, Assistant Conservator of Forests, Mandla Division, with effect from the date on which he may avail himself of it.

No. 3401.—*12th August 1879.*—*Mr. E. D. M. Hooper*, Assistant Conservator of Forests, 2nd Grade, in these Provinces, has passed the prescribed examination in Hindustani, by the Higher Standard.

No. 3483.—*16th August 1879.*—*Mr. F. C. Hicks*, Assistant Conservator of Forests of the 3rd Grade in these Provinces, is promoted to the 2nd Grade, with effect from the 12th June 1879.

No. 3485.—Three months' privilege leave of absence is granted to *Mr. H. Moore*, Assistant Conservator of Forests, Nagpur district, from the 18th instant, or the subsequent date on which he may avail himself of it.

No. 3532.—*26th August 1879.*—*Mr. H. Moore*, Assistant Conservator of Forests, Nagpur, availed himself, on the afternoon of the 20th instant, of the three months' privilege leave granted to him by Notification, No. 3485, dated 16th idem.

No. 3680.—*Mr. E. Ludlow*, Assistant Conservator of Forests, Mandla Division, availed himself on the forenoon of the 22nd ultimo, of the two months' examination leave granted to him by Notification No. 3235, dated the 1st idem.

6.—BRITISH BURMA GAZETTE.—

No. 76.—*11th August 1879.*—*Mr. C. W. Palmer*, Assistant Conservator of Forests, 3rd Grade, having complied with the conditions prescribed in paragraph 17 of the Forest Department Code, is promoted to the 2nd Grade of Assistant Conservators, with effect from the 25th December 1878, in accordance with the provisions of section 55 of that Code.

No. 78.—*13th August 1879.*—Revenue Department Notification No. 96, dated the 15th June 1876, granting *Mr.*

G. W. Strettell, Deputy Conservator of Forests, 2nd Grade, two years' furlough to Europe under the provisions of section 10 (a) of the Civil Leave Code, is hereby cancelled.

No. 80.—*2nd September 1879*.—Under the provisions of section 44 of the Civil Leave Code, *Mr. H. C. Hill*, Officiating Deputy Conservator of Forests, Pegu Circle, is granted two months and 29 days' privilege leave, with effect from the date on which he may avail himself of the same.

7.—**MYSORE GAZETTE.**—

No. 104.—*5th July 1879*.—*Mr. J. T. Jellicoe*, Assistant Conservator of Forests, Nagar Division, is granted one month's privilege leave from date of departure.

No. 12.—*17th July 1879*.—The three months' privilege leave granted to *Mr. W. King*, Assistant Conservator of Forests, Coorg, in Chief Commissioner's Notification No. 11, dated 20th June last, is cancelled.

Mr. King is granted fifteen months' furlough on medical certificate under section 4, Supplement F, Civil Leave Code, from the 4th August 1879, and subsidiary leave under section 35, Rule 2, Civil Leave Code, from 9th June to 3rd August.

No. 15.—*11th August 1879*.—The subsidiary leave granted to *Mr. W. King*, Assistant Conservator, Coorg, in Notification No. 12, dated 17th July 1879, is extended to 7th August 1879, or date of sailing of the S. S. "Navarino."

No. 18.—*19th August 1879*.—In supersession of this Office Notifications No. 12 of the 17th July 1879, and No. 15, dated 11th August 1879, *Mr. W. King*, Assistant Conservator of Forests, Coorg, is granted fifteen months' furlough on medical certificate under section 4, Supplement F, Civil Leave Code, from the 9th July 1879, and subsidiary leave under section 47, Rule 5, Civil Leave Code, from 9th June to 8th July 1879.

8.—ASSAM GAZETTE.—

- No. 20.—*1st July 1879.*—Under the provisions of section 6, Act XIV. of 1874 (Scheduled Districts Act), the Chief Commissioner has been pleased to invest *Mr. W. R. Fisher*, Assistant Conservator of Forests, Goalpara Division, with the powers of an Assistant Commissioner under the Assam Settlement Rules, to be exercised within the Eastern Duars.
- No. 165.—*4th July 1879.*—*Mr. G. H. Young*, Sub-Assistant Conservator of Forests, reported his arrival at Cachar from Dehra Dún on the 5th June 1879.
- No. 23.—*24th July 1879.*—*Mr. W. E. D'Arcy*, Assistant Conservator of Forests, Sibságar Division, assumed charge of the Golághát Forest Division, in addition to his own duties, on the afternoon of the 5th July 1879.
- No. 187.—*5th August 1879.*—*Mr. A. J. Mein*, Assistant Conservator of Forests, is declared to have passed in Assamese by the Higher Standard.
- No. 25.—*19th August 1879.*—*Mr. H. G. Young*, Sub-Assistant Conservator of Forests, was attached to the Office of the Deputy Conservator of Forests, Assam, from the 5th of June until the 4th of August 1879, both days inclusive.
- No. 26.—*19th August 1879.*—*Mr. W. B. Savi*, Assistant Superintendent of Police, made over charge of the Cachar Forest Division to *Mr. H. G. Young* on the afternoon of the 4th instant.
- No. 207.—*4th September 1879.*—Privilege leave of absence for two months, under section 42 of the Civil Leave Code, is granted to *Mr. A. J. Mein*, Assistant-Conservator of Forests, 2nd Grade, Gauhati, from the 1st September 1879, or from any subsequent date on which he may avail himself of the same.
- No. 28.—*10th September 1879.*—In exercise of the powers conferred by section 19 of the Indian Forest Act, 1878, the Chief Commissioner hereby declares the lands described in the schedule hereto annexed to be a reserved forest from 1st November 1879 :—

District.	Pergunnah or other sub-division.	Name of Forest.	Description of boundaries.
Darrang...	Shikar Monzah, Mangaldai sub-division.	Addition to the Khaling Duar Reserve.	<p><i>West and North.</i>—The line fixed by the British boundary Commissioner between the Bhutan Hills and British territory from boundary pillar No. 101 to the Nonai river.</p> <p><i>East.</i>—The Nonai river from the British boundary in the north to the south-western corner of the Khaling Duar Reserve.</p> <p><i>South.</i>—A Survey line running from the south-western corner of the Khaling Duar Reserve in a westerly direction to the stone prism forming the north-eastern boundary of the Sajunbahi grant, then along the north boundary of that grant to the stone prism forming its north-western boundary, then in a south-westerly direction to the stone prism forming the north-east boundary of the Bhutialyhar grant, and along the north boundary of that grant to the stone prism forming its north-west boundary; then due west to frontier boundary pillar No. 101.</p>

No. 214.—*Mr. A. J. Mein*, Assistant Conservator of Forests, 2nd Grade, availed himself of the privilege leave granted in Notification No. 207, dated 4th September 1879, and made over charge of the Gauhati Forest Division to *Mr. G. Mann*, Deputy Conservator of Forests, on the forenoon of the 8th September 1879.

No. 231.—*The 30th September 1879.*—*Mr. W. E. D'Arcy*, Assistant Conservator of Forests, 2nd Grade, availed himself of the privilege leave granted in notification

No. 223, dated 22nd September 1879, and made over charge of the Sibsagar and Golaghat divisions to Forest-ranger, Babu Sri Gopal Banerjee, on the afternoon of the 21st August 1879.

No. 31.—1st October 1879.—The Chief Commissioner has been pleased to sanction the following rules under Section 25, Clause (i) of the Indian Forest Act, 1878 :—

I.—The hunting of elephants in Government reserved forests is permitted only under such conditions and restrictions as may be prescribed by the Chief Commissioner.

II.—The poisoning of water flowing into or through Government reserved forests is prohibited.

The Chief Commissioner is also pleased, under Sections 2 and 73 (a) of that Act, to direct that the officers mentioned hereafter shall exercise severally the powers of "Forest Officers" under the Sections of the Indian Forest Act, 1878, specified below :—

I.—All Deputy Conservators, Assistant Conservators, and Sub-Assistant Conservators, when in charge of Forest Divisions or Forest Districts, also all Deputy Commissioners and Sub-divisional Officers, to exercise powers under Sections 20, 35, 37, 38, 45, 46, 47, 50, 60, 67, 71, and 82.

II.—All Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, Rangers, and Foresters, subordinate to any officer of Class I, and when specially authorized in that behalf by the Chief Forest Officer or by the Deputy Commissioner of the District, to exercise powers under Sections 25, 33, 60, and 67.

III.—All Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, Rangers, Foresters, and Forest Guards, whether on permanent or temporary establishments, to exercise powers under Sections 45, 52, 55, 56, 63, 69, and 82.

IV.—The chief Forest Officer of the Province to exercise powers under all or any of the sections specified above.

V.—The chief Forest Officer of the Province, all Deputy Conservators, Assistant Conservators, Sub-Assistant Conservators, also all Sub-divisional Officers, to have powers under Section 24 of the Act, with the previous sanction of the Deputy-Commissioner of the District, to stop ways and watercourses in Government reserved forests, subject to the provision of that section.

The Chief Commissioner is further pleased to cancel Section 6 of the Assam Forest Rules published in the *Assam Gazette* of the 16th September 1876, page 502.

9.—BOMBAY GAZETTE.—

No. 3455.—1st July 1879.—In exercise of the power conferred by section 4 of the Indian Forest Act, 1878, His Excellency the Governor in Council is pleased to appoint *Mr. W. H. Horsley* to be Forest Settlement Officer in the Districts of Kaládgi, Belgaum, Dhárwár,

and Kánara, for the purposes set forth in section 4, clause (c), and section 34 of the said Act.

2. Under section 16 of the said Act, the Governor in Council is also pleased to appoint the Collectors of Kaládgi, Belgaum, Dhárwár, and Kánara to hear appeals in their respective Districts from any order passed by the said Forest Settlement Officer under sections 10, 11, 14 or 15 of the said Act.

No. 3630.—*10th July 1879.*—In exercise of the power conferred by section 4 of the Indian Forest Act, 1878, His Excellency the Governor in Council is pleased to appoint the Assistant Collector in the Panch Maháls to be ex-officio Forest Settlement Officer in that District for the purposes set forth in section 4, clause (c), and sections 28 and 34 of the said Act.

2. Under section 16 of the said Act, the Governor in Council is also pleased to appoint the Extra First Assistant Collector in charge of the Panch Maháls to hear appeals from any order passed by the said Forest Settlement Officer under sections 10, 11, 14 or 15 of the said Act.

3. Government Notification No. 2094, dated 19th April 1879, is hereby cancelled.

No. 3969.—In exercise of the power conferred by section 4 of the "Indian Forest Act, 1878," the Governor in Council is pleased to appoint the undermentidone Assistant Collectors in Násik to be Forest Settlement Officers, in the tálukas specified opposite their names, for the purposes set forth in section 4, clause (c) and section 34 of the said Act:—

Mr. H. R. Cooke, first Assistant Collector, as regards the Nándgaon, Bágán, Kalvan and Málegaon Tálukas.

Mr. J. A. Baines, Second Assistant Collector, as regards the Násik, Sinnar and Igatpuri Tálukas.

Mr. J. B. Alcock, Supernumerary Assistant Collector, as regards the Nipbád, Chándor, Dindori and Yeola Tálukas.

Under section 16 of the said Act, the Governor in Council is also pleased to appoint the Collector of Násik to hear appeals from any order passed by the said Forest Settlement Officers under sections 10, 11, 14 or 15 of the said Act.

No. 4001.—*31st July 1879.*—*Mr. W. G. Betham*, Assistant Conservator of Forests, is allowed privilege leave of absence for three months.

14th August 1879.—*Messrs. Ganesh Krishna Shahne*, Sub-Assistant Conservator, and *T. B. Fry*, Assistant Conservator, respectively delivered over and received charge of the District Forest Office, Gñjarát Circle, on the 7th August 1879, before office hours.

Messrs. W. G. Betham, Assistant Conservator, and *Ganesh Krishna Shahne*, Sub-Assistant Conservator, respectively delivered over and received charge of the District Forest Office, Kolába, on the 11th August 1879, after office hours.

Messrs. Govind Ramchandra Mahajan, Sub-Assistant Conservator, and *R. S. F. Pagan*, Assistant Conservator, respectively delivered over and received charge of the District Forest Office, Sholápur, on the 6th August 1879, before office hours.

No. 4342.—*20th August 1879.*—His Excellency the Governor in Council is pleased to make the following appointments and promotions in the controlling Staff of the Forest Department in this Presidency, including Sind :—

Mr. W. H. A. Wallinger, Deputy Conservator of the 2nd Grade, to act as Deputy Conservator of the 1st Grade, during the absence of *Mr. Barrett*.

Mr. W. S. Heston to be Deputy Conservator of the 2nd Grade.

Mr. J. L. Laird to be Deputy Conservator of the 3rd Grade, and to act as Deputy Conservator of the 2nd Grade, *vice Mr. Wallinger*.

Mr. P. R. Desai and *Mr. G. St. P. L. Gibson* to be Deputy Conservators of the 3rd Grade.

Mr. R. C. Wroughton to act as Deputy Conservator of the 3rd Grade, *vice Mr. Laird*.

Mr. T. B. Fry to act as Assistant Conservator of the 1st Grade, *vice Mr. Wroughton*.

Mr. J. C. Stobie to continue to act as Assistant Conservator of the 3rd Grade during the absence of *Mr. Barrett*.

Mr. A. Watson to be substantive *pro tem* Assistant Conservator of the 3rd Grade.

Mr. A. D. Wilkins to be substantive *pro tem* Assistant Conservator of the 3rd Grade until the arrival of *Mr. Gleadow*.

Mr. S. Kenrick to be substantive *pro tem* Sub-Assistant Conservator of the 1st Grade, and to act as Assistant Conservator of the 3rd Grade during the absence of *Mr. Greatheed*.

Mr. M. D' Cruz to be substantive *pro tem* Sub-Assistant Conservator of the 1st Grade, *vice Mr. Wilkins*.

Messrs. Annaji Venkatrao and *Govind Ramchundra Mähajan* to be Sub-Assistant Conservators of the 2nd Grade.

Mr. F. S. Menezes to be substantive *pro tem* Sub-Assistant Conservator of the 2nd Grade, *vice Mr. D' Cruz*.

Mr. Lakshman Ballal Oke to be substantive *pro tem* Sub-Assistant Conservator of the 3rd Grade, *vice Mr. Menezes*.

Mr. A. Watson acted as Assistant Conservator of the 3rd Grade from 21st May 1879 to 20th August 1879.

No. 4354.—In supersession of Government Notifications Nos. 1944 and 2227, dated respectively the 12th and 26th April 1879, it is hereby notified that *Mr. W. S. Heston*, Deputy Conservator of Forests, was on furlough in India from 26th March 1879 to 21st May 1879.

No. 4945.—16th September 1879.—In modification of Government Notification No. 4342, dated 20th ultimo, His Excellency the Governor in Council is pleased to make the following appointments :—

Mr. A. D. Wilkins to be Assistant Conservator of Forests, 3rd Grade.

Mr. A. Watson to officiate as Assistant Conservator, 3rd Grade.

Mr. B. J. Haselden to be Sub-Assistant Conservator, 2nd Grade, and to officiate as Assistant Conservator, 3rd Grade.

Mr. S. Kenrick to be Sub-Assistant Conservator, 3rd Grade, and to officiate as Assistant Conservator, 3rd Grade.

Mr. M. D'Cruz, Sub-Assistant Conservator, 2nd Grade, to officiate as Sub-Assistant Conservator, 1st Grade.

Mr. Annaji Venkatráo, Sub-Assistant Conservator, 2nd Grade, to officiate as Sub-Assistant Conservator, 1st Grade.

Mr. Govind Ramchandra Máhajan to be Sub-Assistant Conservator, 3rd Grade, and to officiate as Sub-Assistant Conservator, 2nd Grade.

Mr. F. S. Menezes, Sub-Assistant Conservator, 3rd Grade, to officiate as Sub-Assistant Conservator, 2nd Grade.

Mr. Ganesh Krishná Shahne, Sub-Assistant Conservator, 3rd Grade, to officiate as Sub-Assistant Conservator, 2nd Grade.

24th September 1879.—*Mr. S. Kenrick*, Assistant Conservator of Forests, reported his arrival to the Conservator of Forests, Northern Division, and received charge of his duties under *Mr. Wallinger*, Deputy Conservator of Forests, Poona, on the 12th instant, before office hours.

We regret that as we do not receive the *Madras Gazette*, we are unable to give notifications from that presidency.—Ed.

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INDIAN FORESTER.

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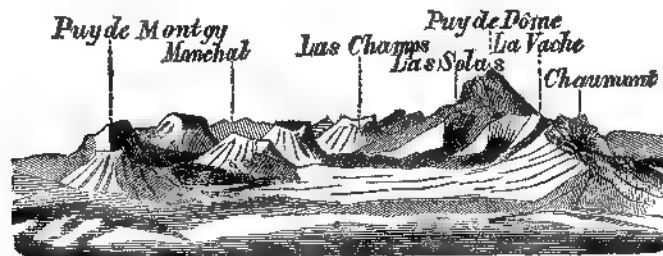
[No. 3.]

A few days in Auvergne.

BY A LADY.

As my brother was taking four of the English students of the Forest School at Nancy to visit the reboisements in the Auvergne, I thought it would be a good opportunity of seeing something of that part of the country. We set out in the middle of April, too early under any circumstances for seeing the country with advantage, and particularly so this year, as the season was very backward. Still, out of the ten days spent in the Auvergne, half the time was very fine, and so altogether we were able to see a good deal.

Clermont Ferrand was our first halting place. On arriving by Railway from Vichy, the hills forming the range of the *Monts Dôme* present an aspect striking from their peculiarity, and must be at once recognised as being of volcanic origin by any one who has ever seen a Volcano. The town of Clermont Ferrand is situated on the slope of the granite plateau, on which rises the group of extinct Volcanos, here called *Puys*, and overlooks the rich plain of the *Limagne*, to which the



Loire mountains form a background. The *Puy de Dôme*, a dome-shaped extinct Volcano, rises immediately at the back of the town, and is a conspicuous object, as it is considerably higher than the surrounding *Puys*. These are about seventy in number, and form a nearly continuous chain running north

and south, about two miles in width, and twenty in length. These Puys from a distance look like gigantic mole hills, and rise from 500 to 1,000 feet above the granite plateau, which in its turn is 1,600 feet above the plain of the Limagne. The town is large and well situated, and in general appearance unlike a French town, there being nothing gay or bright about it. It is built almost entirely of black or iron grey lava, and the streets are paved with the same, the general aspect of the place calling to mind the towns round Etna and Vesuvius.

The Cathedral is a fine but unfinished edifice, built on the top of the hill on which the town stands: and, in consequence, towers nearly its whole height above the surrounding houses. It was built in the eleventh century, and the interior is pleasing from its great height and elegance of design. Some of the painted glass is very beautiful. On Sunday it looked to its greatest advantage, as the crowd of peasants, nearly all in the costume of the country, helped to light up the gloomy colour of the building, which, like the rest of the town, is of basalt.

Our first excursion was to Gravenoire, one of the most recent craters of eruption. It is situated about five miles from the town, south-west from it, and just above the now well-known watering place of Royat, on the first contreforts of the granite plateau. The cone has been successfully covered with a plantation of Scotch firs, now about fifteen years old, and nearly a square mile in extent. It is a good example of the use of forests in such localities. Before it was commenced some fifteen years ago, the torrents, pouring down the sides of the cone, washed away the hill sides and buried the vineyards below with their debris, so much so that all cultivation of the vines on the rich slopes below Royat had to be abandoned. At the present moment the bed of the main torrent is nearly grown over with grass and shrubby plants and all the land below it is in a high state of cultivation. As in other volcanic countries, the vine flourishes, especially on the old lava streams; and it is easy to trace these currents by the luxuriance of the vegetation on them, that on the granite soil being everywhere poor in comparison. It is curious to see how the trees have taken root, and succeeded in establishing themselves

in what is nothing but a hill of volcanic scorie and puzzolano, and are gradually forming a good soil where no soil before existed. In fact, on parts of the cone, where the slope is too rapid for any vegetation to cling, the red and black cinders looked as fresh as if the fires had only gone out yesterday, and volcanic bombs and teal-drops were picked up at every step. These plantations have been made by simply sowing the fir seeds in horizontal bands traced on the sides of the hill. When the seeds had once germinated, which they do from the moisture derived from the rainfall, the young plants themselves do the rest, thanks to the well-known property, which the fir tribe have, of imparting to the soil on which they grow the elements necessary for their own nutrition.

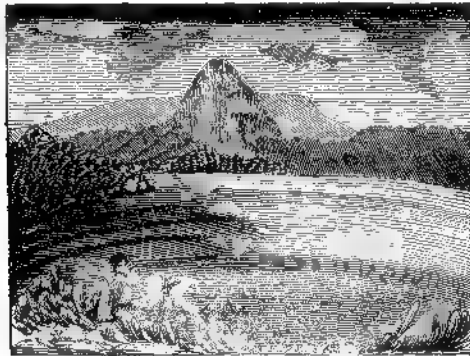
We had a most successful day in every way for our ascent of the Puy de Dôme; one of those rare days which sometimes come to break the monotony of a spell of bad weather, beautifully bright and clear, with a few feathery clouds chasing each other across the deep blue sky, and casting dark purple shadows here and there over the landscape. We started at eight in the morning, and drove to the foot of the mountain, the Brigadier of the Forest Department, who accompanied us to show the plantations, being our guide. A very large plantation, extending all over the south side of the Puy de Dôme, and covering the plain as far as the Puys of Salomon, and Moutchié was first visited. It presented no new features from that we saw the day before on the Puy de Gravenoire, except that the Scotch fir was mixed with the Austrian and some other description of pine. Our carriage was now sent round to meet us at the foot of the Puy de Parion, when our mountain excursion should be terminated. There is a very good zig-zag road up the side of the great cone, made for the use of the meteorological station which has been built at the top. It took us barely an hour to walk up, allowing plenty of time to admire the curious and beautiful view over the surrounding Puys, which are dotted over the plateau, as well as of the distant mountains. Mont Dore, the Etna of the district, about twenty miles away, was the finest object presented to our view. It rises 6,217 feet above the sea level, or nearly 1,400

feet higher than the Puy de Dôme. It was covered with snow, and looked most imposing and un-get-at-able, as indeed, it subsequently proved to be from the amount of snow which had lately fallen. On the top of the Puy de Dôme are very extensive remains of an ancient Roman Temple, dedicated to Mercury, which have only very recently been discovered in making excavations for the foundation of some of the observatory buildings. The temple dates from the second century, parts of the wall, which is built of blocks of basalt, and well-finished, remains intact; also the fragments of Corinthian capitals of good workmanship and style. As these remains have been so recently unearthed, no notice of them is to be found in any of the guide books.

We mounted the tower of the observatory, which the assistant in charge very civilly permitted us to do, though we were not furnished with an order. From thence a thorough view of the surrounding country was obtained by us, and all the plantations which cover the plateau were pointed out by the Brigadier. They cover an area of rather more than 4,000 hectares, or about 10,000 acres, those in the immediate vicinity being to the west, covering the westward slopes of the plateau towards Chambois, and to the north, partly covering the Puys of Chopine and Chaumont; those in the immediate vicinity being to the west, covering the western slopes of the plateau towards Chambois; and to the north partly covering the Puys of Chopine, and Chaumont. The view over the mountains of the Loire and the plains of the Limagne was very beautiful, calling to mind the well-known picture of the plains of Heaven, and having the mysterious domes on the horizon. It is to be noted that it was on the Puy de Dôme that in 1648, Périer, the brother-in-law of Pascal, made the experiments with a column of mercury, which led to the invention of the barometer.

We descended the Puy de Dôme straight down its steep northern side, here and there through patches of snow. It is clothed, as indeed are most of the Puys, almost entirely with coarse grass and heather, except where, like Gravenoire, they are covered with flourishing young forests. We crossed the

flank of the Petit Puy de Dôme, which nestles close to the great Puy, and in the summit of which there is a very perfect, but small, crater, called by the peasants the "Nid de Poule," or Hens' nest. Thence we crossed the flanks of the Petit Suchet to the Puy Pariou, one of the most perfect craters of the group. The Puy de Pariou is considered by Mr. Scrope as one of the most recent craters of eruption, and the Lava which flowed from it, may be easily traced over a large extent of country. Its cone, composed of Scorie and Puzzolano, was evidently thrown up subsequently to the issue of the lava stream, and rises 738 feet above its base. In the summit is a most perfect bowl-shaped crater, 300 feet deep, and 3,000 feet in circumference, the inclination of the sides of the cone, both within and without, being about 35° , and the top culminating in a sharp ridge. Owing to the porous character of the sides of the cone, it has escaped deterioration from the rain, as would have inevitably been the case, had it been composed of harder materials, or placed like Gravenoire, immediately at the edge of the plateau, so that it would have given way at the base. As the rain falls, it never collects, but sinks in immediately; and therefore, never erodes the craters' sides, by



forming sills and channels. Here just inside the bowl, we sat down to rest, and refresh ourselves with some lunch, after our long rough walk. We were quite sheltered from the wind, and had an interesting view across the bowl of the fine craters of the Chopin, Chaumont, etc. to the north, when at last we got up, and began to think of moving on, we saw to our astonish-

ment that a heavy snow storm, the approach of which the Great Puy had concealed from observation, was just upon us. So we hurried on, and raced the storm to the little Auberge at about half a mile from the foot of the Puy, where we found our carriages, crossing on our way the encampment and range of the Artillery, which in summer come here for practice. The storm soon cleared off, and we had a pleasant drive of two hours back to the Hotel. The whole excursion had taken us about nine hours.

The next day we went to collect fossils at Georgovia, which is also interesting as being the scene of Cæsar's only defeat by the Gauls. It is one of the several isolated plateaux capped with basalt, which here rise to a considerable elevation above the plain of the Limagne. Napoleon III. made large excavations on the site of the ancient Gaulish camp and town, and many objects of interest were found, among others flint arrow heads, pottery, and some gold ornaments, which are now to be seen in the Museum at Clermont Ferrand. The search for fossils was not particularly successful, though it is a well-known geological locality.

Our next move was in the direction of Mont Dore. In a deep and narrow valley close under the mountain, lies the little village of Mont Dore les Bains, a mass of Hotels, Pensions, and Boarding Houses, forming one of the numerous Baths which abound in this part of the country, for the accommodation of the seekers after either pleasure or health. Mont Dore, it should be said, takes its name from the stream, the Dordogne, which has its source in its flanks, and not because there are any gold deposits in the neighbourhood. Here, as at Royat, St. Nectaire, and other places, are remains of old Roman baths, and at Royat the old Roman bathing establishment is still in part used. From Clermont Ferrand we got a small omnibus, drawn by three sturdy grey horses, that we hired for three or four days to take us from place to place. It is quite the best way of doing this part of the country, and, in fine weather, would be most enjoyable. The road from Clermont Ferrand to Mont Dore lies over the high plateau between the line of Puys, winding round under the south side of the

Puy de Gravenoire, then crossing a vast lava bed, and traversing the line of Puys between the broken down craters of "La Vache" and "Las Solas," and the Puy de Charmont, now covered by a magnificent young plantation of Scotch and Austrian Firs. From this point the plateau is dotted with numerous young plantations, many of them of considerable extent, made by the Forest Department, but belonging to the various Communes: most of these plantations are in a flourishing condition, though the trees are occasionally much broken by the weight of the snow. We were prevented from giving more than a passing glance at these by a fearful storm of snow and hail which swept the plateau during the whole afternoon. Indeed, it seemed at times as if the hurricane of wind would overturn the omnibus. The highest point of the plateau (over 4,000 feet above the level of the sea) is reached just before the steep descent to Mount Dore commences near the curious clinkstone rocks of *La Tuilière* and Sanadoire. Here parts of the road lay through deep cuttings in the snow drifts, so that we seemed to be in the middle of winter, rather than in April. None of the regular season Hotels being open, we were thankful to obtain shelter in a sort of Commercial Inn or Auberge, where we did very well, but were much amused with the fussy efforts of our host for our comfort, feeling sure that he was not wholly disinterested in what he was doing, our presentiment was verified to the full next morning, when the bill was brought for payment. Paris Exhibition prices, and more than double those of the excellent Hotel we were in at Clermont, were those adopted, and it was only by saying that if we paid the bill it should be sent to Clermont to be put up in the Hotel there as a warning, that our host was induced to accept 15 francs per head for the night's entertainment. Future travellers, putting up at the Hotel de la Paix at Mont Dore, will do well to make an agreement before they take their rooms. As snow had been falling all night, and filled the whole valley, it was useless wasting the too short time at our disposal, by remaining here, so we determined to make our way at once down to more favored regions. Our next point was the well-known geological centre of St. Nectaire, a small village with its two or three

Hotels and baths, open only in the summer. We were obliged to return several miles along our road of the previous day, as the direct road was entirely blocked by snow ; as we descended, the weather improved, and the young men were able to visit some of the plantations we passed *en route*, all of which belong to the Communes. In this bleak country, in spite of the terrible rigour of the climate, the people rarely make a fire in winter, except to cook their food, so scarce is all fuel. Indeed they habitually live in the same apartment as their cows for the purposes of warmth. The enormous blessing of these plantations, as they grow up, may, therefore, in some degree, be estimated by those who have seen the country, as we did, under its winter aspect. In a small dirty village where we baited the horses we were mistaken by the half tipsy keeper of the Auberge for Germans, who told the young men that "he had seen the Prussians, and knew what they were," and requested them "to leave off talking that barbarous language." When the coachman came in, and he found out his mistake, he frantically endeavored to make up by overdoing it with flattering politeness. On arrival at St. Nectaire, the Hotel, which had been shut up for the last six or seven months, had to be opened for our reception. By degrees sundry women and children appeared on the scene, some with sticks and wood for the fire, some with eggs and bread, and a few potatoes. Two or three cutlets were then fished out of somewhere, and a partridge (in April) so that in the end we had a very good supper, before a very comfortable fire, and only feared that some of our entertainers must have gone to bed supperless on our behalf. The old lady who kept the Hotel was most loquacious and amusing. She puffed off herself and her Hotel, as well as all her distinguished visitors, among others, Sir Charles Lyell, Sir Roderick Murchison, Lady Franklin, Lady Herbert of Lea and others ; quality, not quantity, was her motto, she informed us. The neighbourhood is indeed most interesting from a geological point of view, the sections showing well the characteristics of the lavas of the eruptions of the different ages. There are remains of Roman baths here also, and not long ago was found a large vase in red pottery on a stand rather like a font.

There is a calcareous petrifying spring here, similar to, but of greater power than the well-known one at Clermont Ferrand. These springs abound in Auvergne, and are made a source of gain by their owners, the water, by a simple contrivance, being made to drop on the object to be petrified. Among the prettiest of these objects are the bas-reliefs thus produced, which have the appearance of carved ivory. St. Nectaire would be a charming place in which to spend some time in the summer. The scenery around is wild and beautiful, and the Castle of Murol near it, one of the finest remains of feudal times in France. The road from St. Nectaire to Issoire, where we took the train for Le Puy, is very fine, and for nearly the whole distance of the highest geological interest. Views of the high mountains of the Cantal were obtained from several points on the road. At Issoire, while waiting for the train, we visited the Church, an extremely remarkable edifice in the Romanesque style, the ornamentation being a curious mixture of classic and gothic. Round the east end are medallions representing the twelve signs of the Zodiac, and some of the capitals in the interior are decorated with centaurs and other mythological devices, which may possibly have once belonged to some Roman temple. The Railway from Issoire to Le Puy first follows the valley of the Allier, and then crosses the high plateau which separates that river from the Loire, not far from the celebrated Monastery of La Chaise Dieu, which we much regretted that time did not allow us to visit. On this plateau the Silver Fir (*Sapin*) flourishes in a remarkable manner, like it does in the Vosges and in the Jura. Up to this time in Auvergne, we had seen nothing but Pines.

Shortly before reaching Le Puy the Railway descends again into the valley of the Loire. Here it was easy to see that we had once more entered a volcanic district, and the line winds directly under the well-known basaltic columns of Les Orgues d'Expailly.

Le Puy en Velay, the Chef-lieu of the Department of the Haute Loire, is built around the sides of a rather steep hill, crowned by a rock of volcanic breccia, on which, beside the Cathedral, has been erected a huge statue of the Virgin,

some ninety feet high, which was cast out of the cannon taken at Sebastopol. From the head of the statue a very extensive view of the valley of the Loire, and of the surrounding hills as far as Mount Meyene, is obtained. The modern portion of the town is spread out round the foot of the Hill in the valley below. Mount Meyene, the great Volcano of this district, nearly 6,000 feet high, and at this season covered with snow, forms a fine object from the upper portion of the town. The town is very dirty, odoriferous, and at the same time one of, if not the most, picturesque town in France. There is a fine old Cathedral, the principal entrance to which is through a steep street, and then up a long flight of steps, that are partly covered by a sort of elongated portal. There was a famous miracle-working image formerly in the Cathedral, known as the black Virgin of Le Puy. It is generally said to have been brought from the Holy land by the Crusaders; but antiquarians consider that it may have been an image of Isis, whose great centre of worship was at Le Puy, the Aniceum of the Romans, and so may possibly have been an object of veneration before Christian times. In any case, it is considered that the image came from the East. It was destroyed in the Revolution, and has been replaced by a modern imitation carved in wood, with a shiny black face, which does not appear to be considered as equally efficacious with the original. Very curious and picturesque is the rock of St. Michael, an isolated mass of basaltic tufa, standing in the lower town, and rising to a height of nearly 300 feet, almost perpendicular above it. It is about 400 feet in width at the base, and tapers upwards till it is not more than 40 or 50 feet wide at the top. It is crowned by a little chapel of great antiquity, and irregular form as it has been built to fit the top of the rock. There is a winding stair-case cut in the rock, by which access to the summit is obtained. Near the base of the rock are the remains of a Roman temple to Diana. The Museum in the lower town will be found very interesting to any one who cares for Geology, and it contains a very good collection of fossils, in which this district is so rich, including the human remains found under the old volcanic

deposits of Mont Denise. There are also many good Gaulish and Roman antiquities and relics in the Museum.

Mont Denise is at the other end of the valley, about three miles from the town. The summit is a mass of craters, and is covered with red and black cinders, so fresh in appearance, that one might suppose an eruption had taken place but yesterday; on the lower part of the same hill are a double row of basaltic columns of great beauty and regularity known as the "Croix de la Paille," and the "Orgues d'Expailly."

They are of remarkable regularity and very perfect, the columns being each about 60 feet in height. Not far off is the Castle of Polignac, once an important Feudal stronghold. It is perched on one of those strange looking masses of basaltic breccia, similar to Les Rochers de Corneille, on which the statue of the Virgin stands, and St. Michel. Even geologists seem to find it difficult to account for their formation, though probably they were masses of volcanic matter upheaved by eruptions which took place when the whole valley where Le Puy now stands was a Lake, and have been subsequently uncovered by the drying of the Lake and the denudation of the sediment which had formed around them in its bed. The solution of the question made to me by a French Lady was hardly satisfactory, when she solemnly informed me that they had been vomited forth by Mount Denise. The Loire, which rises at the foot of the Meyene, south of Le Puy, passes close to the town, but is hidden from view, as it cut its way through the granite rocks forming a deep and winding gorge several miles in length. From Le Puy the students visited the extensive reboisements near Cayres, about 20 miles south of Le Puy, which were admirably executed, and in excellent condition. The centre of these plantations is a small Lake, formed in an old crater, and altogether the place is very remarkable. The reboisements in the district altogether amount to about 11,000 hectares, and it was much to be regretted that as most of them were situated at a high elevation, and were covered with deep beds of snow at this season, we were prevented from visiting them. Still we had a most interesting and instructive tour, and we only wished that the season was sufficiently advanced

for us to prosecute our journey into the heart of the Cevennes and the Ardèche, as well as around Mount Meyene, where the country is full of interest both from a forest and geological point of view, and where the scenery must be equally striking and beautiful. It was with much regret then that we turned back through Lyons and Dijon to Nancy.

The Forests of Denmark.

IN the *Revue des Eaux et Forêts* for February 1879, an article appeared giving an account of the progress of arboriculture in Denmark up to the year of the last International Exhibition at Paris. A brief *résumé* of the principal points in this account may not be without interest.

INTRODUCTORY.

In former ages, Denmark, like the rest of Northern Europe, was one vast forest of oak and beech, corresponding to the Ban Wälder of Thuringen, and valueless, except as pasture lands for large herds of cattle, goats, horses, and pigs, and for the purposes of the chase.

At the latter end of the 17th century, and at the same time as the question attracted attention in France and Germany, the Danes discovered that unrestricted fellings, and the breaking up of forest land, with grazing and other rights exercised by the villagers, had reduced the wooded area so much, that Government was called on to stop this wholesale destruction. To effect this, several laws were passed. The most important measures were those of 1670 and 1733, which exhibited considerable knowledge of the rules of forestry, in regulating the clearing, lopping, and planting of the forests. All these laws, however, proved ineffectual.

In a flat country with rich soil, both landlords and tenants are but too ready to clear away the forests to make room for the plough. Towards the middle of the 18th century, after some large estates had been cleared of forests, Denmark was less wooded than any other country in Europe. At Copenhagen, the

capital, wood become very scarce and imports from other countries were necessary.

The Danish Government took no further steps in forest legislation until the law of September 27th, 1805, was brought into force, which put a complete check on further devastations, and preserved the remaining forest areas for future generations.

Already by the end of the 12th century, most of the forests ceased to be commercial property, and had gradually passed into the hands of the fœdal lords or become Crown property. The village communities retained, however, rights of pasturage, and their flocks destroyed effectually all that the axe of the land owner spared.

By the law of 1805, these rights were abolished, the grazing of horses and of horned cattle being forbidden in the forests. The law also ordered that all high forest should be kept up. Active supervision by Government secured due attention to the law, which appears to have produced an excellent moral effect and induced landlords to submit their forests to the provisions of the law, although legally only 2-3rds of the wooded area is subject to its provisions.

It is to this law that we owe the present state of the Danish forests.

The coppice woods, which were always of less importance, and to which the law did not apply, have now almost disappeared.

The forest question having once attracted attention, efforts were commenced to afforest the vast bare sandy tracts, which in the Island of Jutland alone covers an area of 2,500 square miles. In 1788 attempts were made to fix the moving sandhills in Iceland, but not until the end of the last century was any systematic commencement made to plant the moors. Between 1791 and 1809 extensive plantations were made in Jutland, Bornholm, and Iceland. These were continued in Jutland up to 1864, and since 1859 the Danish Government has annually planted large areas of the extensive sandy tracts which border the western coast of that province.

The disastrous results of the war in Sleswick-Holstein have spurred on the Danes to improve the territory which they still retain. Thanks to national patriotism, the "Society of the

Landes" was formed in 1866 to utilize the sandy moors and dunes by converting them into forests. Blessed by rich and fertile seasons, protected by the State, and encouraged by the popular voice, this Society has been indefatigable in its work.

The State and private individuals have also done much reboisement, and in the last few years about 1,900 square miles of bare moor have been converted into forests.

DISTRIBUTION, AREA, AND OWNERSHIP OF THE FORESTS.

A glance at the Danish woodlands shows at once that we are only dealing with the remnants of larger forests, scattered at random over the country; the soil and the natural physical features having had no effect on the present situation of the forests. With the exception of three forests, which have an area of 25 square miles each, all the woods are of small extent; they are equally distributed over the whole country, villages being usually not more than 1 to 2 miles from a wood.

The wooded area of Denmark amounts to 43,472,000 acres, besides 3,558,000 acres of young plantations which as yet are unproductive. Of this area, about 30 per cent. belongs to the State and 70 per cent. to private parties.

The proportion of the wooded to the cultivated area is as 1 to 9·6 in the islands and as 1 to 25·1 in Jutland; for the whole of Denmark the area covered with wood is 4·6 per cent. of the total area.

In conclusion it should be mentioned that there are very few commercial forests in Denmark.

SOIL AND CLIMATE.

The soil is generally well suited to forest growth. The surface is level and free from rock; the formation is quite recent, tertiary and the older strata being rarely met with.

The principal soils are:—

(a)—Loamy clays generally covered with light, damp surface soil, bearing forest growth similar to that of the North German plain.

(b)—Sandy soils on which we find sometimes well-grown high forests, but wherever the beech suffer from drought, a hard black

crust forms on the surface. This layer consists of 30 to 40 per cent. of Humic Acid, the ordinary proportion of which in good beech soil is from 2 to 7 per cent. With this sort of soil and a very small percentage of lime, all deciduous trees, and especially the beech, fail to thrive, and conifers have generally to be introduced. Springs frosts do some harm, but less than in countries further inland. The undulating ground and the small scattered blocks of forest present no obstacle to the wind, which more or less retards the tree growth and dries up the light sandy soil.

GENERAL REMARKS ON THE STATE OF THE FORESTS.

The undulating nature of the ground also implies many variations of soil which make it somewhat difficult to have unhomogeneous forests. All the woods are divided into many small blocks, each of which is differently stocked; this mixed character of the forest growth necessitates of course special treatment.

Of the total forest area 70 to 84 per cent. is stocked; the remainder, consisting of arable lands which the forest employés cultivate, of meadows, lakes, and roads.

At the commencement of this century the system of securing natural reproduction by a graduated series of clearings was introduced in the place of the *jardinage* or selection cuttings, and is now used both in State and private forests.

The forests are bounded by a ditch and bank, the latter being planted with a hedge. Roads are neither expensive nor difficult to be made in so level a country, and traverse the country in all directions.

DISTRIBUTION OF THE DIFFERENT FOREST TREES.

Formerly the forests consisted almost exclusively of oak and beech; during the last 100 years conifers have been gradually introduced, and they now cover a considerable area.

For many centuries there was a running fight between the oak and the beech; the latter has gradually invaded the oak forests, and now covers a larger area than any other species. The oak still stands on damp low lands and on the poor sandy

soils of Jutland, but on all the richer clays and limestones the beech is the principal tree.

The beech in Denmark grows to the same size as in Germany, notwithstanding the fact it here approaches its northern limit. Its natural reproduction is easy on all good soils.

The oak is becoming less common every day. *Quercus pedunculata* is the common species—*Q. Robur* being only found in some parts of Jutland and Bornholm. The oak rarely grows alone, except in some damp, cold soils, where the remains of old oak forests are left with an underwood of hornbeam and hazel. In this way it grows as high as the beech, and when cut at an age of 120 years, the mean annual growth is 3 hundredths of the cubic metre that in a forest of mixed stocking being 5 hundredths of a cubic metre. In some parts of the sterile sandy tract of Jutland are still found gnarled oaks, the remains of fine forests, with an undergrowth of juniper.

The ash, maple, elm, lime, and hornbeam are only grown in clumps mixed with the beech.

It is interesting to note here that the hardy hornbeam growing to perfection in the south Danish provinces is not found north of Denmark.

The alder is useful in low, swampy lands, mixed with birch; the latter grows with the aspen in the sandy soils of Jutland.

Excavations in the peat moors prove that the country was formerly covered with forests of Scotch fir mixed with birch and aspen. In the course of year, the Scotch fir gave way to the oak, as the latter has now been ousted by the beech.

Up to the middle of the 18th century, the only representative of the coniferæ was the juniper. Since then conifers have been gradually introduced, and they now cover an extensive area. The spruce is the most common, the Scotch fir and the Weymouth pine being less thought of. For covering bare sandy moors the spruce is used planted with *Pinus uncinata*; another silver fir, *Pinus austriaca*, being less used now than formerly.

The Scotch fir, which has succeeded so well in the North German moor reboisements, has failed in Denmark.

The conifers grow well, with the exception of the larch, which only yields a soft poor wood.

Here it is interesting to note the changes proposed in the stocking of the forests in the twenty years,—period 1865-75 to 1875-85.

			Percentage of Area stocked in 1855-65.	Proposed stocking in 1875-85.
Beech ...	...	...	51.77	42.18
Conifers	...	...	31.37	48.59
Oak ...	...	...	7.42	4.90
Soft woods	...	...	5.34	8.56
Other species	...	...	4.10	0.77

During this twenty years period the beech yielded 71 per cent. of the total products, the oak 9 per cent., conifers 12 per cent., and other deciduous trees 7 per cent.

Again, during the same period, of the total area re-stocked, either naturally or by artificial means, the beech covers 40 per cent., the oak 2 per cent., soft woods 6 per cent., and conifers 52 per cent.

If it be borne in mind that the figures given above do not comprise the large fir plantations on the moors, the change in the stocking of the forests is most remarkable; a few centuries ago, the oak was as common as the beech, whilst only 100 years back, conifers, which now cover half the forest area, were almost unknown.

From a financial point of view, these changes are far from favorable, as the fir timber is worthless for export.

The conifers suffer sometimes severely from caterpillars and larvæ, *Bombyx Monacha*, which in Eastern Prussia frequently devastates whole forests of the Scotch fir, is also found here, whilst *Tortrix buoliana* is a great pest in young plantations of that tree.

The Weymouth pine has been almost exterminated by the variety of *Peridermium Pini* which lives on the bark. The scab, *Peziza Willkommii*, does more or less damage to the larch.

GENERAL MANAGEMENT, ROTATION, &c.

The effect of the law of 1805 was naturally to stop the spread of coppice woods. The few coppices that now exist are chiefly alder brakes. Stored coppices, formerly very common, generally oak with hazel underwood, have mostly been converted into high forests.

The rotation is generally shorter than that current in Germany.

The rapid growth of the trees, and the ready sale for all sorts of timber, allow a short rotation with a good return on the capital.

Fellings are generally commenced when the annual increase of growth is insufficient to yield a proper return on the capital invested.

Beech high forests are generally cleared when 80 to 100 years old, and oaks when 100 to 120 years old. At these ages, the annual growth no longer represents a 3 per cent. return on the capital value of the forest. The ash, maple, and elm stand about as long as the beech; alder brakes are cleared every 25 to 30 years.

With the conifers there is even greater difference between their rotation in Denmark and in Europe generally. The inferiority of wood prevents its being used for any but the roughest work, and large timber would never find a sale for inland or foreign consumption, so that the spruce is generally cleared when from 50 to 80 years old.

It is only when mixed with beech that Scotch fir and farch are sometimes allowed to stand 100 years.

Until the system of natural reproduction, by carefully graduated cuttings, was introduced from Germany towards the middle of the eighteenth century, the method in use was similar to the French *tire et aire*.

Since then the annual yield and cuttings have been fixed by various German formulæ, but chiefly by the combined method of area and standing stock.

The modern German school, led by Frederick Pressler and Heyer found in the rapid growth, and the ready sale of small timber, better fields in these forests for the application of their principles than elsewhere.

In making working schemes, the maximum return on the capital is always kept in view, and the annual yield is never fixed for more than ten years in advance.

REPRODUCTION.

Artificial means are generally used for re-stocking forests in Denmark. The beech is the only species which is made to reproduce naturally, and even here the stocking has to be completed artificially. Natural reproduction has chiefly failed owing to very severe frost, or preparatory clearings followed too soon by the second or seed fellings.

The soil under the parent trees has often to be worked in strips, patches, &c. ; harrows have been much used in loosening the soil before the mast falls. On soils with the hard surface crust mentioned above, deep working is required for the success of the natural seeding.

With the oak, the natural process of reproduction has been abandoned in favor of sowing and planting.

The plants used are three to six years old, except in the case of beech and conifers, for which younger plants are taken. The plants are raised in nurseries. The average loss in transplanting is 26 per cent.

Where so much artificial aid has to be given, the expenses are considerable, the average being about 16 rupees per acre. The reboisement of the moors was commenced by sowing broadcast or in patches; now holes are dug with a spade, or the soil is ploughed throughout or in strips with a deep subsoil plough, following the plan so successfully carried out in afforesting the Hanoverian Heide. The plough goes to a depth of 18 to 24 inches, and the work costs 40 to 80 rupees an acre.

DISTRIBUTION OF THE DIFFERENT SPECIES.

For many reasons it is advisable to have a mixed stocking in the Danish forests. The small wooded area, the high prices at which all forest products sell, point to a intensive cultivation of the soil, which may be easily brought about by mixing the stocking in planting or sowing.

Young beech woods, when about eight years old, are generally mixed with spruce nurses, which are cut out in the first thinnings. On good soil, hornbeam and ash are mixed with the beech; sometimes larch and Scotch fir are mixed singly with beech; standing till the latter reaches maturity, they yield valuable timber. Similarly, larch is sometimes mixed with the spruce.

The oak grows too slowly to admit of its being planted with nurses of the same age. Seedling oaks which came up with beech of the same age are soon overgrown and die down when 50 to 70 years old. Oaks are, therefore, raised alone until they are 40 to 45 years old, when the ground is sown or planted with beech nurses. With other thin foliage trees, such as Scotch fir and larch, the introduction of beech nurses has been most satisfactory.

THINNINGS.

These are more severe in the Danish forests than elsewhere. This is partly due to the ready sale, found for all small wood and also to the experiments of Count Reventlow, M. Oppermann, and others. Thinnings commence at the 20th year, and are repeated at intervals of three to seven years.

In the article from which these particulars are taken, a table is given contrasting the effect of light and severe thinning. In a beech high forest between the 20th and 41st years, 4,400 cubic feet per acre being cut out against 6,000 cubic feet, the respective mean diameters being at 80 years of age, 32 centimetres and 42 centimetres—a difference of 30 per cent in favor of the latter or heavier thinnings, against which must however be put a slight excess in the height of the closer standing trees.

Thinnings are also severe with trees of thin foliage, care being also given to the production of the soil by nurses.

YIELD AND PRODUCTS.

On the whole, the yield of the Danish forests is low, compared with that of State forests in other countries, 150 cubic feet per acre being the average yield per annum. This is partially account-

ed for by the inferiority of the soil, and the fact that close on 20 per cent of the area is mistaken with forest. Wood fetches, however, always a high price, except where it has to compete with peat fuel. Putting the capital value of the soil and standing trees at 80 to 120 per acre, most of the State forests are found to return 3 per cent interest.

WOOD TRADE.

The chief inland trade is in fire wood. Building timbers are chiefly imported from Norway and the Baltic parts.

The average annual imports of wood from 1871 to 1875 were—

Firewood	80,000 cubic metres	... Value,	5,20,000
Grantlings	340,000 cubic metres	... Value,	1,12,00,000

This represents about one-third of the total consumption of the country.

INDUSTRIES.

There are no important manufactories of primary forest products. Good mills are few in number, owing to the scarcity of running water. The manufacture of *sabots* (wooden shoes) in Jutland is the only industry worthy of mention.

FOREST TAXES.

The unit of area on which the forest dues are levied is connected with an ancient custom of 1688. The unit of taxation was then fixed at the area sufficient for the nourishment of twenty-four pigs. Pigs are no longer kept in the forest, but this unit or *Tönde Skoosbylds Harthorn* is retained in the same way as the agricultural taxes are levied by a corresponding standard.

Forest land pays an annual tax of from 8*d.* to 20*d.* an acre.

FOREST ADMINISTRATION.

The State forests are under the finance ministry. The service consists of 3 conservators, 22 inspectors, with 6 assistants, who form the superior staff; the subordinates are 42 rangers, 10 district guards, and 230 guards. Working plans are drawn up in a separate bureau by one officer with 4 to 6

assistants. The inspectors correspond to the German oberförsters, having executive charge of their forests, and the execution of the work laid down in the working plans, approved by the conservators and the finance minister, who acts as the head of the departments.

The average area of an inspector's charge is 4,200 acres. All wood is sold by auction.

The conservators control the general working of the forests and advise the finance minister in technical matters. The Forest School Examinations have to be passed for the post of inspector; some of the rangers have also passed through the Forest School.

STATE SUPERVISION OF PRIVATE FORESTS.

The working of the private forests is controlled by the ministry of the interior. The law of 1805 abolished all grazing rights and forbade the clearing of all high forests. Owners of large properties, burdened with rights of usage, were empowered to free their estates by making over to the right holders areas not covered with wood. High forests standing at the time the law was passed were to be well looked after under penalty of fines.

Purchasers of forests were forbidden to cut any wood for ten years without permission, except such as they and their tenants required for their personal use.

The minister of the interior was, however, authorised to allow high forests to be cleared if an equal area was planted elsewhere. By another law, the sub-division of forests under 135 acres extent was forbidden.

The superintendence of these and other provisions of the law is entrusted to the prefets and sous prefets, the practical supervision being carried out by vine specially appointed forest officers. Commercial, village and glebe forests are also managed by the latter.

INSTRUCTION OF FOREST OFFICERS.

The first Forest School was established in 1785, at Kiel in Holstein, where the principal Prussian dockyard now is the

Forest School now forms part of the Agricultural College at Copenhagen.

The course of instruction lasts four to five years, of which one or two are spent in practical work. The subjects of study are the same as those of the French and German schools.

FOREST LITERATURE.

The numerous Danish works on forestry are chiefly unknown to foreigners from the difficulties of the language.

A review, devoted to forest subjects, was commenced three years ago with a subvention from Government. India may, therefore, pride herself on having previously started and kept up a similar periodical in the *Indian Forester*.

On Teak-planting in Bombay.

Being an Extract from a demi-official letter, dated the 23rd November 1879, from D. BRANDIS, ESQ., to the Private Secretary to His Excellency the Governor of Bombay.

PERHAPS His Excellency would permit my submitting a suggestion regarding the teak plantations along the Kalinadi river, which I examined in 1870, and which, I am glad to see from Sir Richard's Minute, are being extended. With very rare exceptions teak does not form pure forests, but is associated with other kinds, and it thrives best when growing in company with other trees. The Nilambur plantations are pure teak, and this is, I fear, a serious drawback to their ultimate success. My views upon this subject are based upon the study of the growth of teak in all parts of India where it forms forests, and they are supported by the experience of foresters in Europe in regard to the growth of oak which in some respects has requirements analogous to those of teak. They are shared by Indian foresters in Burma and the Central Provinces; and, though the Forest Officers in Madras have not yet come round to these views, they will find that, as their trees in Nilambur get older, it was a great mistake to attempt to grow pure teak forests. In 1870, I submitted my views on this subject to

Colonel Peyton, and perhaps he has already acted upon my suggestions in the extensions which have been made since that time. But there will be no harm in again urging the matter. The plan which I have advocated in teak plantations of late years consists in this,—not to clear the entire area to be planted, but only to clear bands at certain distances. The older plantations on the Kalinadi will, in future, serve as an example of pure teak forests, while, if my present suggestions are accepted, the extensions now to be made will be an attempt to raise mixed forests with a large proportion of teak, sufficient to make these forests remunerative. The bands to be cleared should be 10 feet broad or thereabouts, up to, say, 15 feet. In these cleared bands the teak should be planted in two continuous lines, close together, and these bands should be kept clear of weeds until the teak is sufficiently advanced to keep down grass and weeds by the shade of its own foliage. The jungle between two bands should be left standing to a width of, say, 40 feet, and in this belt of jungle only grass and brushwood need be cleared during the first year or two after the teak plants have been sown or planted in the bands, so as better to guard against damage by fire, in case the fire protection of the whole area in any season should not be successful. The entire area of the plantation will then be arranged thus :—There will be alternative bands each stocked with a double line of teak, 10 feet broad, and belts of the original jungle intervening, which will be 40 feet wide. Should there be any sale for the inferior kinds of wood standing upon the intermediate belts, the jungle may be thinned out, the more valuable kinds being left standing. Up to the present time, the cost of these plantations, as stated in His Excellency's Minute, has been Rs. 70,000, expended upon 960 acres, which amounts to Rs. 73 per acre. But under the modified plan now suggested, the outlay per acre will be much less, and one-fifth of the area only will be stocked with teak. The width of the bands to be cleared and planted with teak, and the width of the jungle remaining standing, must vary according to circumstances, and the figures here suggested must in no way be accepted as applicable to all cases. It may be found convenient

to give the belts of jungle a less width than 40 feet, and to increase the breadth of the cleared bands. But the general principle of alternate belts of teak and natural forest is sound; it diminishes the first outlay upon formation; it diminishes the cost of weeding, as all that is required is to keep clear the planted bands, until the grass and weeds are killed by the shade of the adjoining forest and the planted teak, and the result will be, a much more healthy growth of the teak and less damage by parasites and insects, which are apt to do great injury in pure teak forests, and chiefly, more moisture in the soil, which, under the defective shade of pure teak, dries up rapidly. Bamboos and evergreen trees are the best companions of teak, but where these are wanting, there are other kinds, which, though not green throughout the year, retain their foliage longer than teak, and are therefore useful in keeping the ground in the vicinity of teak cool and moist. To those who are acquainted with well-managed oak forests in Europe, the analogy between the companions of teak here suggested, and the beech as a companion of the oak, will at once suggest itself. At the same time it will be remembered that there are pure oak forests (chiefly of *Quercus pedunculata*) in favoured localities on moist alluvial soil where the oak thrives well, although growing alone and without an admixture of other trees, or with only a small proportion of other kinds, and it may be that on those portions of the Nilambur plantation, which are on deep alluvial soil, rich and moist, teak will succeed well, although pure, but on the other hand it must be remembered that there are very few instances of pure teak forests, even upon alluvial soil, and that these are not very satisfactory as regards the shape of the stems and the stature of the trees. Forest Officers in Burma will agree with me in this remark, when they consider the small pure or nearly pure teak forests in that province, of which it may suffice to mention the forests on the Martaban Beeling, the lower Bonee forests and the Shwoay Kyoondau near Pongday. The stems are fluted and the trees are altogether badly shaped.

Local circumstances may, in some cases, render a different arrangement advisable. These stretches of low ground or of

stiff clay soil may not be uncommon in tracts selected for planting. In such places, teak would not succeed at all, and when forming a teak plantation, such places must, as a matter of course, not be planted with teak. It may thus happen that instead of regularly alternating belts, the teak may be planted in irregularly shaped stretches of ground particularly suitable for its growth, the intervening land, which is less suitable, being left clothed with its natural forest. But the general principle, to which I have here endeavoured to draw attention, and which I feel sure is correct, is, that in a teak plantation, the whole area should not be cleared and planted with teak, but only a portion, either belts alternating with the standing forest or patches of ground particularly suitable for the growth of teak.

It follows from these remarks that if in a pure teak plantation trees of other kinds make their appearance, either self-sown, or as shoots from underground stools, their growth should be rather favoured, and that they should not be thinned out.

The chief drawback of the plan here advocated is, that a larger area must be protected from fire. But if attention is paid to the shape and the boundaries of the blocks taken in hand, the increased cost of protecting a larger area does not increase in proportion to the size of the area protected; and, though in the Government forests of some districts protection from fire is as yet the exception and not the rule, this state of things will eventually cease, and in the end we may hope that the whole area of the Government forests will be protected against fire.

But until that is accomplished, the protection of these partial teak plantations against fire will be more expensive and will require more care than in the case of pure teak plantations. This additional expense and trouble is, however, small, as compared with the cost of a pure teak plantation of equal area and with the risk of injury from various causes to which pure teak plantations are exposed.

Famine, Forests, and Sub-soil Moisture.

THERE has been much discussion going on about how the extension of forests may modify droughts and famines; but from our point of view what touches us much more directly, is the inverse proposition—how do droughts affect forest? It is really a very important question, and one from which a good deal of interest springs. One is too apt to regard nature as immutable, because it changes slowly and nothing suffers more from the dogma than forests. It is natural that jungle fires should occur in this climate; it is natural that a poor man should cut a quarter of an acre of saplings to build a cow-shed; why interfere? Similarly, the primeval forest has stood this sort of drought since the last geological epoch; it is fancy to suppose it can come to any particular harm now. Our little forest world has doubtless facts and opinions to the contrary, and it would be matter of congratulation if these could be drawn forth. In Europe, no one knows how far his pet exotic may be really acclimatized, how far a difficult plantation may have within itself the elements of permanency and self-maintenance till an unusually severe winter, like the past for instance, has passed over the scene. Here, in this country, drought is the “meteorique” to be feared, the test to be passed.

The writer has lately had opportunities of visiting most of the forests and the plantations in the part of Mysore where the late droughts were most severe. It would hardly have been expected that their effects should be more apparent in natural than in artificial forest; yet there is no doubt, now that the stunted and unpromising growth on rugged gneiss hills of which most of the “high” forest consists has suffered most, and the plantations, composed mainly of an Exotic, *Casuarina equisetifolia*, the least. The nearly useless thorny scrub, which is the form the natural forest takes on more level ground, has its sprinkling of dead trees, but the better class of forest among the hills has suffered more. On the hills themselves, the gaunt skeletons of *Vatica laccifera*, sandal, teak and acacias, and in the valleys the bristling clumps of grey bamboo amongst the green, show where the drought has passed. In the plantations, on the other hand, among the *Casuarina* trees planted up to the

end of 1875, the deaths during the drought of 1876 and the two abnormal years of 1877 and 1878, could be counted on the fingers. The last four years have been trying ones for tree-life. 1875 was a year of short rainfall. In 1876 the rain which fell (about half the average) was of little use to deeply-seated vegetation; in 1877 the South-West monsoon rain failed; this past year there has been hardly any North-East monsoon rain. The late droughts, by, in part, withdrawing the usual supplies of rainwater have afforded a favourable opportunity of observing how trees make up the deficiency with sub-soil moisture, and deducing what the ordinary action of this may be. It is an agency whose importance has not hitherto been recognized. In a dry climate, and not only a dry climate but also in a wet one with a dry season of any length, the presence and distribution of sub-soil moisture may be the governing factor in the presence and distribution of forest. This is indeed a very safe assertion, for the distribution of forest has puzzled the best Naturalists. Mr. Darwin's discussion of the subject at page 46 of his "*Voyage of a Naturalist*" is a case in point. Much of the apparently capricious growth of trees in the wooded parts of this country and the dearly bought experience of plantations in unwooded parts seem however to be capable of explanation when sub-soil moisture is considered.* There is, for instance, the phenomenon of "sholas," patches of moist evergreen forest filling up *certain* valleys in a bare grassy country of rolling hills. The hills are steep, not high, and the rainfall is above 40 inches. Sholas occur on the Neilgherries, above the Western Gháts, and on other hills with a tolerably heavy rainfall. Jungle fires and exposure to wind are in themselves insufficient to account for those sharply defined limits of rich evergreen forest, and, in the dry season, burnt up grass which characterize sholas. I have watched a shola, clean cut for coffee, gradually re-asserting itself in spite of fires and wind. In fact, jungle fires in this climate deteriorate, but there is every

* Dr. Brandis, at page 30 of his review of Forest Administration in the Central Provinces (April 1876), cites a case of sal seedlings dying down repeatedly before they were able to definitely establish themselves. This was in a part of the forest fire-protected for years. A tap root at first at a depth of insufficient sub-soil moisture is a suggested explanation.

evidence that they do not prevent forest growth. Supposing, for the sake of argument, that they did, and that sholas were circumscribed by fires, the edges of the shola where the forest and the fire struggled should present a fringe in evidence. There is no such fringe, nor in fact any evidence of fire-deteriorated forest around the shola proper. Wind may be almost left out of the question. It is only in exposed situations that its action is important, and there, as a gradually extending influence, first worrying the forest, then stunting it, then reducing it to shrubs, and finally extinguishing it. Considering the distribution of sub-soil moisture sholas can be explained with the exact appearances which they present.

Sholas only occur among low steep hills. Towards the end of the dry season, the soil at the top of these hills will be too dry to support tree life. There is a constant flow of moisture, from below upwards, by capillary attraction, caused by the fierce evaporation from the surface under the influence of a tropical sun and parching winds. More searching than wind or sun is the draining action of high evergreen forest. With its roots at a depth where capillary moisture is abundant and apparent to the touch and sight, the hill tops are drained of the moisture which would have passed upward to them. At the same time forestal conditions with the immensely improved capillary power of a spongy soil are brought in, all over the valley under forest. This perfect capillarity will diffuse moisture pretty equally as far as the forest extends up the hill side. As soon as the forest ceases, the drawing and distribution of moisture ceases. Any unlucky seedling outside the pale of this natural irrigation, that is, on a higher level than it, is cut off by it from all access to moisture and perishes during the dry season. On this view the *total of forest occurring there depends on the sum total of sub-soil moisture available during the dry weather*, and this may be taken as stating the case generally with regard to forest and sub-soil moisture. That this quatum of dry season sub-soil moisture should be expended in feeding a small patch of evergreen instead of a much larger area of deciduous forest we take to be due to the distribution of the sub-soil moisture. In a country broken into small steep hills and

one where the geological formation is massive gneiss and trap, every now and then appearing at the surface, as in southern India generally, there would naturally be a very unequal distribution of sub-soil moisture; a variableness intensified, whenever forestal conditions are set up, in the manner described. The striking difference in character between the centre of the western belt of forest in Mysore and the southern portion of it, seems to be only explainable by a consideration of the different distribution of sub-soil moisture in the two. Both lie just inside the Western Gháts and have a similar rainfall. The central portion, Manzerabad, has a mean elevation of 700 or 800 feet above the southern. In the first, the underlying gneiss, schistes and trap are nearer the surface, which is consequently more broken than in the second, but otherwise the topography is very similar. In Manzerabad the forest is scattered, often poor and open, but it is high, and preserves its general evergreen appearance, till the rainfall drops to less than 40 inches and the country becomes flatter. In South-west Mysore the forest—teak, bamboo and associated trees—is higher and finer than in Manzerabad, but it is strikingly deciduous. As a whole, it is perfectly continuous and unbroken, forming a great contrast to the varied woodland and park-like scenery of Manzerabad. In the teak forests the even distribution of sub-soil moisture produces a continuous forest, but the sum total available during the dry weather being approximately equal in both cases, the greater drain of the teak forest exhausts its sub-soil moisture before two months of the dry season are over. Then, till the next showers, the country becomes a howling wilderness, traversable with difficulty; the dirty pools of poisonous water being miles apart, and often the only source of supply. No green thing can exist; species of an evergreen habit, or even those where the fall of the leaf is short, are very rare. Coffee has been tried and naturally proved an utter failure, although the early spring showers, on which much of the success of coffee cultivation depends, are here better than in Manzerabad. Sandal, an evergreen which grows luxuriantly where the forest has been felled, is never found within or near it. The common species

of Fici, the hardiest of trees, but whose fall of the leaf is short, average about one to the square mile. Wild elephants, it is true, pull down and devour them greedily; but trees of this genus generally pass their youth out of the reach of quadrupeds, and it is astonishing that so common a genus everywhere else in forests should be so rare here.

As a matter of observation, sub-soil moisture is, as a rule, at too great a depth to be reached by any ordinary well; but on going east, among the villages where the country has been cleared, and where the rainfall is actually less, wells and the common village trees, green as usual, are met with everywhere. In fact, leaving a village with its green trees and water, and going into the forest in any direction, the same striking transition to an utterly dried up condition of nature is noticeable.

Manzerabad, especially the forest portion of it, with its coffee and cardamoms, is rich and populous: the southern teak forests shelter a few tribes of aborigines. Economically, were the teak forests of the latter fully stocked, which they are so far from being at present, they could never rival in value the varied agricultural productions of the former. The cause of this difference is most accurately described by saying that the distribution of their sub-soil moisture is different.

Again, the first regular plantations in Mysore were on scrub-covered land in the east plain country. Land, bare with the exception of tufts of scattered grass, could equally have been obtained, but naturally that already partially wooded was preferred. Planting in the midst of these scrubs, however, was found to be utterly disheartening. Tree well planted, well rooted, and thoroughly established in their pits, refused to grow and gradually died out. Systems, possible and impossible, were tried till it was proved to demonstration that we could not oust the natural growth by planting amongst it. To plant you must first get rid of the scrub by cutting and burning several times over. Except on very good soil it is not economical to do this. It had been observed from the first, in any piece of scrub land, that where the natural growth was thickest no planted trees grew, where it was thinner they grew partially, and on sites clear of scrub planted trees grew well. It was evident

that the planted trees were not choked by the scrub in the sense of being deprived of light and air; because each planted tree stood in a yard cube pit, and therefore in a little clearing of its own. It was certain also that the shelter afforded by the scrub and its power of arresting rainfall were in themselves beneficial.

In fact the only explanation is, that the sub-soil moisture which, from the comparative flatness of the country is diffused, and from its dryness is scant, was altogether taken up by the indigenous scrub already in possession. A remarkable feature of this scrub observable when large pits are dug amongst it, is the great development of root compared to the little there is to show above ground—the terrestrial, compared to the aerial ramification, as old writers state it. If one could afford to dig enormous pits, and coax the roots of one's planted trees to a depth where they would tap the sub-soil moisture first, it might be easy to starve and kill the ugly growth around. On the other hand, the planting of the *bare* wastes of deep rich loam which occur in Eastern Mysore is, with ordinary care and some experience, of certain success. Wherever there is a market or a demand for wood, as in the case of railway sleepers, it is certain to be highly remunerative.

Here, again, the returns depend mainly on sub-soil moisture. A good soil must be chosen, or it will certainly not pay to plant at all; but with a good soil the yield is observably dependent on sub-soil moisture.

Of the species tried in plantations; *Casuarina* is undoubtedly the best. It used to be heresy at Nancy to acknowledge to any sneaking affection for exotics as forest trees. The national bent may have warped their judgment, and they have every reason to be satisfied with their forests as they are. On the other hand, it is impossible not to be led by the views of Mr. Alfred Wallace and other Naturalists who have made a study of the North European and American forest floras. They maintain—and all the proof obtainable seems to bear them out—that the specifically poor forest flora of Northern Europe is capable of enrichment by the acclimatization of most, if not all, of the Northern American species. The forest flora of Europe is

stated to contain 85 species, but not one quarter of these, as every one knows, go to make up the bulk of the forests. There are geological reasons accounting for the poverty of the forest flora of Europe. A fact which seems to have been overlooked in these views is the innate hardihood of certain species over others in the intense struggle for existence which supervenes in the comparatively mild climate of Northern Europe, and the small differences, almost trifles, by which natural reproduction is affected.

In a dry tropical climate the struggle is not one for existence—tree against tree for space to live in, but of all tree life against the drought of the dry season. There is, then, little natural reproduction and very little artificial aid serves to turn the scale one way or the other in favor of the species constituting the forest. The objection which has been urged against a *Casuarina* plantation that it is not self-reproducing is probably one which is to a great extent true of all high forest in this climate. The natural forest in Central Mysore after years of fire exclusion will probably resolve itself into a coppice—under-standard class, natural reproduction never being sufficient to enable one to convert it into *futaie*. *Casuarina* may, or may not, be as long lived as some indigenous trees; but it is pretty certain that its physical maturity falls after the period at which it would pay best to crop it. The permanency of young *Casuarina* plantations has been well tested by the late droughts; and, as has been noticed, they have come through it better than the natural forest. There was a cessation of visible growth in the established planting, though doubtless a forced and deep root growth. There was an abnormally large percentage of failures in the planting done during the worst year of drought, 1876; but, what remained, passed unscathed through the less severe drought of 1877, and when the abundant South-West monsoon of 1878 fell, a remarkably rapid period of growth ensued. One plantation, an old friend of some years standing, was hardly recognizable after a six month's absence; in fact we utterly lost our way once in a dense thicket where six months before the view around was hardly broken by an occasional nodding top shoot. There was little

noticeable in the indigenous planted species. Their slow growth seems to have ceased during the worst of the droughts and to be now going on much as before, but small changes in their feeble progress towards trees are difficult to note. Possibly indigenous species might give better results from *in situ* sowings, on land which has been once cropped with *Casuarina*.

Starting with the advantage of a forest soil, they might be got to grow up thick and help one another forward. But it is curious to notice how even the hardiest of them cease to grow and look like dying in parts where they have come up thick from seed, as in abandoned corners of a nursery. Sown broadcast or in shallow pits they have, over and over again, given results which are nearly negative. Indeed, another exotic, *Cassia florida*, seems to be the only species really reliable for *in situ* sowings. It comes up freely enough during the usually light showers of the South-West monsoon, but not early enough to allow it to be deeply rooted against the ensuing dry season. Grown isolated, as when planted in pits, it remains little better than a bush unless there is a pretty abundant sub-soil moisture.

But it is unfair at this stage to say too much against indigenous species. Many remain yet to be tried, and it is uncertain how far their graceless forms might not be put into shape associated with *Casuarina* and planted not further than three yards apart. All the old planting, nearly, was done at five yards, and it is certain that three yards apart would have been much better and *more economical* in the end. At three yards apart on fair soil, *Casuarina* will close overhead in five years, and there is already then a spongy deposit of decaying detritus, between which and the increasing gloom, grass and low growth fight a losing battle. It is just possible that on an old soil of this description a regular *coupe d'ensemencement* may be possible, but we have never yet found a natural seedling in *Casuarina* plantations. The oldest of these are seven years, and they have borne cones for the last two or three years. Forty miles from the Western Gháts we have noticed *Casuarina* seedlings amongst the grass under old isolated trees, but they never survived the hot weather. In the eastern plantations the condi-

tions would be more in favour of natural reproduction; the rainfall less so both in distribution and quantity.

To come now to financial results, which must be glanced at briefly in a paper with this heading. The success of the present system of planting may be looked on as established, but the expense of the large 3-feet cube pits is heavy. Neglecting distances apart, the cost of planting (work alone) at current rates, is Rs. 64 per thousand trees :—

	Rs.
Pits taken at a little less than 24 per rupee = 8	
pie each	40
Filling pits per rupee 250	4
	—
Total for pits = Rupees ...	44
	—

Other charges come to Rs. 20, so that the cost of pitting is 69 per cent. of the whole.

Other charges per 1,000 trees :—

	Rs.
Nursery formation	1
Watering for five months	3
Transplanting and watering for a month afterwards per rupee 63	16
	—
Total for Nursery plants ...	20
	—

So that the total cost for work, adding the two items Rs. 44 and Rs. 20, is Rs. 64 per 1,000 trees. Planting at three yards apart this comes to Rs. 34 per acre.

Cost of establishment may be calculated thus :—

Add 12 per cent. the pay of mistri and head coolies, (they are actually paid this percentage on the out-turn of work) and the cost per 1,000 plants becomes Rs. 72.

If the pay of a Ranger is added, supposing him to supervise a monthly expenditure of Rs. 2,000, his pay and allowances being Rs. 100, the total is raised by 5 per cent. or Rs. 3, and becomes Rs. 75 per 1,000 trees.

There may, or may not be, a Forest Officer specially in charge of plantations. Supposing there is, and that his pay and

allowances amount to Rs. 600 per mensem, and that he controls an expenditure of Rs. 5,000 per mensem, the total is raised by 12 per cent. or Rs. 7 and becomes Rs. 82 per 1,000 trees.

Rs. 3 per thousand may be added for sundry charges, such as tools, fencing, and stationery, and the total then becomes Rs. 85 per 1,000 trees.

Planting at three yards apart gives 537 trees to the acre, or allowing 7 per cent. for failures 500 to the acre, so that the cost of planting, work and establishment is Rs. 42-8 per acre, failures, in the season's planting, not being paid for.

In criticising this system the strong point is its certainty of success; the weak, its heavy cost under the head of pits, which, as we have seen, are 69 per cent. of the total cost under works. There is ample evidence that for wide planting (200 to the acre) a yard cube is the lowest limit of size of pit, consonant with any certainty of success in planting, or any satisfactory growth afterwards. With the present closer planting it may be possible to reduce the size of pit by $\frac{1}{3}$, or possibly $\frac{1}{2}$, and experiments are being cautiously made in this direction.

In the other 31 per cent. there will soon be a very notable reduction consequent on the adoption of a system of nursery planting in country tile cylinders. Transplanting will fall from about Rs. 63 to Rs. 300, and watering charges from Rs. 333 to Rs. 299, or say fractionally, per rupee, the charges will be from $\frac{1}{3}$ to $\frac{1}{4}$ of what they were, allowing for the cost of the tile cylinders and a slight increase under nursery formation.

Before closing we should perhaps mention that these tile cylinders are those ordinarily made in the country for roofing houses. The cylinder 10" long by 5" diameter is split into two semi-cylindrical shaped tiles. These join together like a broken biscuit, and the split cylinders are placed together side by side, forming a honey-comb. Earth is then shovelled on to the honey-comb and filled up flush. Seedlings are pricked out into the tile cylinders and grow rooted as if they were in pots, but better than if they were in pots, since the space for the roots is below, where it is most wanted. In transplanting one side of the tile cylinder (or in other words one of the tiles) is lifted off and the mass of roots and earth, resting perfectly undis-

turbed on the other tile, is placed in the hole left in a filled up pit, and the earth around filled in. The tile which went in with the transplant is now pressed back, and drawn out with the finger and thumb, the transplant remaining with its roots and root earth exactly as it was in the nursery.

Under the old system, each transplant, rooted in a large cylinder of earth, had to be picked out with spuds from the nurseries. The roots totally unconfined often went to one side and a large cylinder of earth (14" by 6" is the regular size) would be carved out, wrapped in grass, and carried one at a time on women's heads, with, after all, very little root in it. In wet weather transplanting had to stop, because the cylinders of earth could not be got out without breaking. In dry weather, the roots, always more or less cut with the largest cylinders of earth, would not set without watering, which is usually impracticable on a large scale. When the distance from the nursery to the pits was long, the earth cylinders required a good deal of tying up in grass to prevent them being broken, and they could never be carried in a cart on account of the jolting. Sandal is notoriously difficult to transplant; this past season a few sandal plants a foot high rooted in tile cylinders were brought a distance of fifty miles in a country cart over a rough road, and are now growing none the worse for the passage.

Transplanting in tile cylinders, as we have seen, is about one-fifth of the cost of transplanting in the ordinary way; it is more certain; it requires less water; and it permits the carriage of the transplants to any distance and in any manner.

The annexed table gives the result of a cubage taken in one of the oldest of the *Casuarina* plantations. It is situated in Kolar, the most easterly district in Mysore, where (as far as the taluk rainfall returns can be trusted) the rainfall is 30 inches. The rainfall, however, is badly distributed and the plantation owes its good growth to an abundant sub-soil moisture. The appearance of this strip of planting, a perfect little forest in miniature, is most pleasing. The figures of the cost of planting, which have been given, are the current rates at which work is now being done; making a forecast for ten years (the

oldest parts of the plantations are now seven years old). We get a first thinning recommended in about ten years, which, taking out every fourth tree, would yield 125 poles with accompanying branches, pieces of which the net value would vary according to the accessibility of the plantation, from about eight annas to a rupee and a half in Bangalore.

Assuming, therefore, one rupee as the average net value of a ten-year old tree, the financial position of the plantation after ten years is, that *it has repaid all charges twice over and left a valuable forest as a bonus in the hands of the planter.*

The present demand for sleepers for the new Mysore State Railway, gives a practically unlimited market and one at much better rates than those entered here. The figures are sufficiently encouraging ; it is not every bare table land which possesses an exotic species able to afford it free of cost in ten years. It is not every forest species that a man might sow on any Christmas day and breakfast comfortably under its shade that day two years ; this we have seen done, on an average planting soil, and with trees treated in the usual manner.

Cubage taken in the Bengalur Casuarina Plantation, Kolar District, 2nd April 1879.

1	2	3	4	5	6	7	8	9	10	11	12
Girth at 6 feet from ground in inches.	Quarter girth squared in feet.	Average height in feet.	Average cubic content in feet.	Number of trees.	Cubic content, total for each class.	Distance apart.	Age.	Area over which cubage was taken.	Total yield per acre.	Total yield per acre, per year.	REMARKS.
6"	.016	22	.868	35	12.88	Originally planted at 10 feet apart, at present 378 to acre, which is a little less than 11 feet apart, trees have closed overhead and nearly killed all ground herbage.	Six years.	Acres 1.856.	Cubic feet 1234.11.	Cubic feet 205.69.	Vacancies and trees, dominés falling within the cubage = 79. The fraction required to deduce the mean girth from the girth at 6 feet is not known, and at this stage it is not worth while sacrificing trees for its determination. Roughly, and for the present calculation, it is assumed that the cubic content of the branch pieces covers the difference between the two girths. This is well within the mark, judging from the appearance of the trees and what was taken off lately in clean pruning the trunks up to 6 feet, and it must further be remembered that the rule—the square of the mean quarter girth multiplied by the height—gives a volume which is $\frac{2}{3}$ the true volume, while in a timber plantation, the true volume is the one which should be taken.
8"	.027	29	.783	53	41.50						
10"	.043	31	1.333	65	86.64						
12"	.068	35	2.205	84	186.22						
14"	.085	38	3.060	92	281.52						
16"	.111	38	4.218	82	345.88						
18"	.140	42	5.380	53	311.64						
20"	.174	42	7.308	32	233.86						
22"	.210	48	10.080	12	120.96						
24"	.250	50	12.500	3	37.50						
27"	.317	50	15.850	1	15.85						
		Total...		512	1673.45						

KAD-HANDI.

Note on an experiment to determine the relation between stacked fuel and its solid contents, by J. Smythies, Esq., Assistant Conservator of forests, Jaunsar.

AN experiment with the above object was carried out by undersigned at Chakráta in November 1879, but owing to the supply of water being frozen up, it was brought to a premature conclusion. The results, as far as they go, will, however, prove interesting.

A tank, $3\frac{1}{2}$ feet deep, and about $6\frac{1}{2}$ feet square, was built of solid masonry and an escape hole for the water at the bottom was constructed out of a large bamboo. The inside of the tank was finished with smooth plaster.

Two casks furnished with taps were placed on a stand at one side of the tank, and water was supplied to the casks by means of a small canal, being the waste water of the Chakráta waterworks. Each cask was measured to hold 54 gallons, and each was supplied with a rod, graduated to every 10 gallons, (one of them to every 5 gallons.) An imperial gallon measure was used to gauge the casks, and the graduation of the rods was tested carefully twice over.

The empty tank was first of all measured by means of the casks, and it was found that up to a certain mark, which was indicated on all the four walls, when the water was level, 18 casks and 14 gallons were required to fill it, *i.e.*, the tank filled up to this mark held 986 gallons.

The fuel operated upon was fir stacked in lines of 300 cubic feet each ($7\frac{1}{2}' \times 20' \times 2'$); it was placed—a certain amount at a time—in the tank in three parallel lines, and was kept down by 3 strong moveable scantlings, which were themselves kept down by fixed cross beams. The three moveable scantlings were partially immersed in the water every time, but this was allowed for when the tank was measured, *i.e.*, they floated at the top of the water underneath the cross beam, in the same respective positions they held afterwards. The fuel being carefully stacked in the tank, water was admitted a cask at a time, and when the water came up to the mark on the walls, the amount was recorded, it generally happening that eight full casks and a few gallons more were required every time.

The first quantity of fuel placed in the tank being called A, the second B, &c., it was found that the amount of fuel A, required 473 gallons to fill the tank; therefore we have the equation—

$$A + 473 = 986.$$

Similarly B required 472 gallons.

$$\therefore B + 472 = 986$$

and so on. The result for the first two lines (one *stack* or 600 cubic feet) was that

$$A + B + C + D + E = 2600 \text{ gallons.}$$

The result for the second stack was that

$$A + B + C + D + E = 2520 \text{ gallons.}$$

Therefore the sum of the two stacks or 1200 c. ft. stacked fuel = 5120 gallons = $\frac{5120}{6.23}$ c. ft. solid = 821 c. ft., *i.e.*, in stacked fuel about 2-3rds the amount is solid wood.

It remains to examine the possible sources of error in carrying out the above experiment.

The stacks of fuel were the ordinary stacks of 600 cubic feet each as sold to the Commissariat Department, and had been stacked by professional stackers, *i.e.*, by men whose sole business it is to stack fuel for the Forest Department. They were not specially stacked for the occasion, nor would it have been wise to have done so, as the object we were aiming at was to find out the amount of solid wood in an ordinary stack of fuel as sold in Chakráta. Each of the four lines making up the two stacks was measured by me to be $7\frac{1}{2}' \times 20' \times 2'$. Thus there was no error in the quantity of fuel used.

The casks did not leak and their contents were carefully measured by means of an imperial gallon. It was certainly possible to ascertain the amount of water in a cask every time it was used to within $\frac{1}{4}$ of a gallon; and as almost 95 casks were used altogether, the outside error from this source might amount to 24 gallons more or less, which would make a difference of 4 cubic feet in the result either way, or $\frac{1}{2}$ per cent. But it is not likely that the error amounted to so much, and it may be left out of consideration.

The tank did not leak in the least, and it was possible to fill it every time to within three gallons more or less (*i.e.*, an eighth

of an inch in height on the wall of the tank); as the tank was filled ten times altogether, this would amount to an error of 30 gallons, or much about the same as the last error; but care was taken to have this amount rather more than less every time, so as to allow something for absorption by the wood, and this error is of no great consequence.

There remains the error due to absorption of water by the fuel which was two and half years old and exceedingly dry. This amount it is impossible to calculate now, but the only effect it would have would be to increase the amount of water supplied, and therefore to lessen the solid contents of the fuel; for $A + \text{water supplied} = \text{a constant}$.

This error no doubt amounts to something considerable, and it would be advisable to repeat the experiment with *green* fuel some time next year, in which case it will probably be found that rather more than 2-3rds of a stack are solid wood; and it is important to repeat the experiment with both *oak* and *fir*, separately. This would have been done this year had not severe frost intervened and cut off the supply of water.

The result we have at present attained is that 1,000 cubic feet solid wood will yield 1,500 cubic feet stacked fuel, which is the same as the estimate made in Mr. Brandis' Report on the Forests of the Forest School Circle, of 1879, paragraphs 44 and 50.

CHAKRATA, 29th November 1879.

French writers on Indian Forests.

IN a recent article by M. Jules Clavé in the *Revue des Deux Mondes*, as well as in the January 1879 No. of the *Revue des Eaux et Forêts*, notices are given of the forest collections sent to the Paris Exhibition of 1878, on the extent and species of tree forming the forests of British India. The writer does not, however, seem to have taken the trouble to obtain a correct idea of Indian vegetation, as he describes our forests thus :—“ All these trees mixed with shrubs loaded with parasites give to the forests the appearance of a conservatory in disorder in which individual plants are indistinguishable, and not the majestic aspect of the fine forests of our countries, which bear more resemblance

to a gallery of gothic columns." It is not quite clear what he means, unless he refers to the tropical forests such as are met with in parts of Bengal, Burma, and the Western Coast; but it is evident that he has not fully obtained an idea of the gregarious forests of sâl, eng, sissu, khair, babul, etc., and has not fully understood that the forests of North-West and Central India at any rate are not exactly like conservatories run wild, and in reality present an appearance rather the reverse of his description. This is not the only case of inaccuracy in M. Jules Clavé's article; for in his introductory chapter we find him talking of the pitiless war made by Germany on France in 1870. We had always thought that it was the French and not the Germans who declared war. Again, if we understand his words correctly, he talks of the interior of Australia as covered by vast forests of different species of tree. This is not what we have been led to expect from the accounts of the disastrous journeys of the Australian explorers and from the experience of those who laid the telegraph line from Port Darwin to Adelaide. We were also rather surprised to hear that the *hickory* of North America is a species of "ash;" whereas in reality it should more naturally be classed with the "walnut."

M. Clavé's description of the collections sent to the Paris Exhibition is as follows:—"The Indian Government has sent to the Exhibition a collection of more than 600 specimens of 270 species, all fully labelled and classified with the greatest care. It must be said in its praise that for some years it has carefully occupied itself with the conservation and improvement of its forests too long exposed to devastation by the natives. Constantly burnt over for the sake of cultivation the forest in many parts have disappeared to give place to *inextricable jungles serving as homes to beasts of prey*. The Government possesses, under the name of reserved forests, about 24,380,000 hectares, and has a special administration for their management, largely officered by men who have made their studies at the forest school of Nancy."

On the whole we have been much disappointed by M. Clavé's article, as we had certainly thought that his name would be a sufficient guarantee for accuracy of statement.

A Teak Tree with alternate leaves.

THIS curiosity has lately been brought to notice by Mr. E. D. M. Hooper, Assistant Conservator of Forests in the Central Provinces. The plant was grown by him in the Telenkheri Gardens at Nagpore, from seed which he had brought with him from Malabar in 1877, and he found that the leaves, instead of being in pairs alternately at right angles to each other as is the usual case, were alternate, and in the same plane directed north and south, the leaves pointing east and west being entirely wanting.



Major Doveton says that the same thing has once or twice before been observed at Ahiri, but it is nevertheless very curious and interesting.

The European Olive in the Plains of India.

SIR,—It may interest you to know that in the public gardens of the Sialkot Station there are four trees, received in 1867. These were then small trees got out from home by Dr. G. Henderson.

The largest is now 18 feet high and 14 inches in girth at four feet above the ground.

In 1878, they bore fruit, and again in 1879. But the fruit would not mature. It attained the size of large peas, when it turned yellow, and dropped. The fruit was produced abundantly. This was on two trees; the others flowered plentifully, but set no fruit.

The trees are said to be healthy and quite different in appearance from the Indian Wild Olive (*Olea cuspidata*) of the Punjab Sub-Himalayan ranges.

They have never been manured or pruned. They were freely watered when in fruit, but Mr. J. Greenwood, the Superintendent, thinks that the failure of rain affected the fruit.

He has propagated many young plants by cuttings from those trees. It is not, however, known whether they should be manured, and whether any special treatment is required.

Information on these points, from any of your correspondents, would be acceptable.

Yours, etc.,
B. H. BADEN-POWELL.

The Screw Bean and *Prosopis glandulosa* in the Punjab.

As early as 1875, attention was called to these products. It is unfortunate, as far as the Punjab is concerned, that while many plants have grown and some seeded, no one appears to know exactly what the species is. Now, as there are several species, some of which are not only useless but absolutely hurtful to cattle, it becomes of importance to know exactly, (*a*) what species are to be cultivated and what avoided, and (*b*) what is the species which has grown in the province.

We have seen a specimen of a pod grown by the able Secretary to the Financial Commissioner, Mr. J. A. E. Miller. This we

believe to be the first produced in these provinces. It is a long, narrow pod, of a pale drab color when ripe and dry, very like the pod of our common "jand" or "jánt" (*Prosopis spicigera*), only more moniliform and with the lower part tapering down to the fruit stalk. The fruit appears to grow directly on the stem, not on the twigs.

This fruit does not exhibit any 'screw' or twist proper to the *Mesquit* bean of Arizona and New Mexico (and which led to some botanists calling it *Strombocarpus*). It is, therefore, possibly *Prosopis glandulosa* of Texas but not *Prosopis pubescens*.

As early as 21st June 1875, Dr. Hooker pointed out that there were two "*Mesquit Beans*"—one from the eastern, the other from the western parts of the United States, and that one, or both, yielded sweet pods, while the tree was large enough to give "good timber" as well as charcoal, and a gum, equal or nearly equal, to gum-arabic for medicinal and industrial purposes, exuded from the stem.

The Consuls in San Francisco and Galveston were to be applied to for seed, or "any town in the Gulf of California."

The following is the report sent from Western Texas by Dr. Hooker:—

"MESQUIT GUM.—Mr. F. Kalteyer, Treasurer of the Agricultural and Industrial Association of Western Texas, says the Mesquit Gum of that region is almost identical with gum-arabic, having been in use there for medicinal and technical purposes, especially in the preparation of mucilage, gum drops, jujube paste, &c. The past year it has become an article of export, some 12,000lbs. having been gathered in Bexar County, and as much more between that and the coast. No gum is gathered west of Bexar, though the drought was favorable to a large crop. This gum is hardly known east of Brazos. It exudes from the stem and branches of a *Mimosa*, several species of which grow in Texas, New Mexico and Arizona. One of the species, "*Algaroba glandulosa*" (Torrey and Gray, N. A. F., 399) is rarely met with below the mountain regions of Western Texas. The species most common in Bexar County, grows from 20 to 40 feet high, and 18 inches thick. From it charcoal is manufactured. It is gener-

ally used for picket poles, being very durable. It is also made into handsome furniture, the grain being very fine. It grows where no other fruit tree would live. It is favorably noticed in the last Annual Report of the American Pharmaceutical Association.—*Monthly Report of Department of Agriculture, Washington, U. S. A., 1873, p. 158.*"

This is extremely indefinite as to the species, but it leads to the conclusion that the species *Algaroba* (or *Prosopis*) *glandulosa* is rarely met with out of the mountainous regions of Western Texas. The species common in Bexar County (whatever *that species* may be) grows from 20 to 40 feet high, &c. Mr. Miller speaks of *this species* as *glandulosa*, in the letter which reports results to Government, but we do not draw this conclusion from Mr. Kelteyer's note.

All this information came to India with 20 seers of seed called *P. pubescens*:—(10th April 1877, No. 28 C., Government of India.)

This seed was sent—

- 10 seers to Forest Department ;
- 2 seers to A. H. Society, Lahore ;
- 8 seers through Financial Commissioner to Jhang, Shahpur District.

It was shortly after announced that the seed was not *pubescens* but *probably glandulosa*.

It appears that, while 20 seers of seed was sent in 1875 to India, a despatch of 8lbs of the same seed (?)—at any rate also called *pubescens*—was sent to Jamaica. Only a small portion arrived in "a state fit for germination," so a pound of the *Pods* was given to a valuable horse, which died three days afterwards from "belly-ache."

This again is indefinite, as we have no means of being sure whether the pods were really *pubescens*, or were liable to the same correction as was attached to the sample sent to India ; and next, whether the unwholesome effect was due to intrinsic qualities of the pods, or merely to these being unsound, fermented, &c.

The Jamaica recipient suggested that possibly the seed might be *P. juliflora*, the pod of which is known to produce such pain,

at certain seasons, because the seeds swell and ferment in the stomach.

We may remark in passing that *all* pods which are used as fodder may have a similar effect. The pod, while in a certain stage of growth or ripeness, may be digested seeds and all; at another, the pod and its substance may be consumed, while the seed is just hard enough not to be digested, but to ferment and swell in the intestines; at another stage the seed may be so hard that it passes *undigested*, as is the case with the kikar pods (*Acacia arabica*.) It is well known that nothing succeeds so well in growing kikar, as to feed goats, etc., on the pods, and sow the droppings which contain the undigested seed.

Again, in April 1878, (No. 5 F. C. 4th April) the Government of India sent a box of Mesquit Beans "*supposed* to be *glandulosa*," and a farther supply, also *supposed* to be *glandulosa*, were sent on 21st May 1878, (No. 523 F., dated 21st May.)

It would appear from this that we have never received any of the *pubescens*, the species which at the outset was recommended as so valuable, but have received another which is *probably glandulosa*.

This has succeeded at Lahore, in the Changa Manga Plantation (and a few trees elsewhere): at Sakesar (one of the highest points of the Salt Range, Shahpur district) and at Amritsar. A later supply succeeded fairly (to the extent of 42 trees) in Hushyarpore itself, and some in Unah. 12 trees in the garden at Umballa were in flower in May 1879, and some 30 trees at Jalundur. The trees were about 3 or 4 feet high in about a year's growth, and had long straggling branches.

The matter having gone so far, has now been referred to Kew to know what species are really good and what really dangerous. It should also now be ordered that species,—small branches with flowers, and later, the same with seeds—should be lightly pressed between sheets of *unglazed* native paper, or ordinary blotting paper, and sent for identification. Beyond changing the papers once or twice, no care or skill is required in drying specimens and no press or other apparatus required. A very light pressure of a few books is all that is needed.

This remark may not be superfluous for non-botanical readers.

On the possibility of adopting the cubic foot of solid wood as the unit of measurement in the case of Bamboos. By Col. G. J. Pearson.

Extract from a letter to the Inspector-General of Forests.

I HAVE had a long talk with Monsieur Boppe, the Inspector of the Forest of Haye, on the subject of paras. 54, 55, 56 of your annual review. I merely submit it for your consideration. He says as follows:—

To represent the annual production of a given surface of forest, it is necessary to choose a *unit* or *factor*, to which every one can assign at once in their mind a definite given value.

Now it seems impossible to assign for bamboos a *solid cube* as the factor, because they are *hollow*, and because they have not all the same thickness of solidity, or rather because the *hollow* is of various diameters; and you cannot say that a certain number of bamboos of a certain girth represent a certain solid cube measure.

Monsieur Boppe thinks that the only possible unit to assume with bamboos is the *running* foot or *running* metre, *i.e.*, that an acre produces so many *running* feet of bamboos per annum.

This certainly *may* for *general* review, in reports and projects for working plans, be reduced *eventually* (if you desire it) to *cube measure*; for instance it *may be accepted* that so many *running* feet of bamboos of each class should go to make up a 100 cubic feet, or if you prefer it so many *tons* of wood; but he thinks that it is an error to show it in the returns of the forest as such, and will only mislead as a rule.

Here for instance in the return of the produce of a forest, faggots are never debited as *cubic feet* of wood. It is said that an hectare for instance produces so many cubic mètres of scantling-timber, so many mètres of firewood, and so many faggots. In the *amenagement* of the forest in calculating the annual produce it is the practice to allow so many faggots (this differs in different localities) to each stère or cube, so as to reduce the actual produce of the forest to one term, but this is not the way in which it is shewn in the returns.

334 ON THE POSSIBILITY OF ADOPTING THE CUBIC FOOT, &c.

Again, as regards vine props, of which there are no less than 36 different classes, they are divided into bundles of 50 or 100 each, and are exhibited as such in the returns of sales of wood, and it would be considered misleading to represent them by cubic contents; although, like faggots, in considering the annual production of a certain area, no doubt *so* many bundles would be allowed (at a certain known rate) to a stère or cubic mètre.

What Monsieur Boppe seems to think the most important is to have in all forests *certain well-defined and known measures*, which are accepted by the wood merchants and population generally, *and also* by the Forest Department. All bamboos, for instance, should be *classed* according to the usage for which they are intended, and tied up into bundles of the *same* number; each class should always be cut to the *same length*, and have the same number of bamboos in each bundle; firewood in like manner should be always cut to the same length and stacked in piles of a certain known length, breadth, and height. If order and regularity be insisted on in these points, it will be very easy in the control office, whenever it is required for the purposes of higher administration, to reduce the forest returns to any unit you find desirable.

But as bamboos are *hollow*, he thinks you will be much safer and nearer the truth in assuming a *running* measure as your unit, and *not* a solid measure.

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III. OFFICIAL PAPERS.

Forest Conservancy in Bombay.

THESE Minutes by His Excellency Sir Richard Temple, Bart., Governor of Bombay, should have appeared before in our pages, but were merely kept back for want of room. We hope that the lateness of publication will not have diminished the interest with which every Forester must read the Minutes of so great a friend of Forest Conservancy as the present Governor of Bombay :—

Forest Conservancy in the Deccan.

Dated June 4th, 1878.

THE need of regularity in the supply of moisture and water in the Deccan has been brought into such prominence by the drought and famine of 1877, that I need not attempt to describe it.

But, together with my honorable colleagues, I have been forced to consider the relation which the preservation of forests, jungle and vegetation may bear towards this subject.

Whether it be certain or not that forests affect the regularity and the distribution of the annual rainfall, (though probably most people believe they do, which belief is shared by myself and my colleagues), it is certain that they do affect the supply of moisture and water in the country generally, and especially the many rivers which traverse the Deccan from the west in a direction either easterly or south-easterly. From this point of view all considerations concerning forests, jungle and vegetation become grave; but they acquire additional gravity when we have undertaken, or are about to undertake, a system of irrigation works dependent on these rivers.

I need not enter upon the considerable results which have been already attained by forest conservancy in the Bombay Presidency during recent years, not touch upon the national wealth in wood and timber which has been thus preserved for

the public benefit. I will restrict myself to such suggestions as concern climate and water-supply, and to particular matters in which further improvement is unquestionably desirable and practicable.

I bear in mind that, if we attempt to bring under forest or jungle any considerable area beyond that which we already have, we must be careful not to interfere unduly with the rights and the requirements of the rural population, which, despite losses occasionally from drought, disease and scarcity, is increasing and pressing upon the culturable land. It is also to be remembered that many pieces of land which we might desire to see under forest have been awarded to the villagers under a land revenue settlement, which must be preserved inviolate. Such pieces, therefore, can be acquired only by purchase under the law, or by exchange, or by special arrangement.

Still I believe, from what is to be seen, heard, or ascertained, that the District Collectors, in conjunction with the Forest Officers, might manage to improve or preserve the vegetation in many localities, which are specially important in reference to climate and water-supply, without trenching on the rights or requirements of any one. And, adverting to this, I have to record, for the consideration of my honorable colleagues, certain observations in detail.

These observations will refer only to Khandesh and the Deccan—and not to the Southern Deccan, nor the Konkan, nor Gujerat. The principles to be indicated probably are applicable to all parts of the Presidency alike. Still the following observations are directed to the local peculiarities of the Deccan.

The points to which additional attention should be directed seem to me to be the protection of the forest, the jungle, and the vegetation,—*firstly*, on the water-shed line of the Sahyádrí range, commonly known as the Western Ghats; *secondly*, on the springs, sources, and head-waters of the rivers which spring from that range; *thirdly*, on the top ridges and upper slopes of the cross ranges of hills which branch off eastwards from the main range of the Sahyádrí.

As regards the first point, the water-shed which really divides the Deccan from the Konkan is always to be traced as a clear line of physical geography. Indeed it is the most important and remarkable line in this part of India. It varies much in altitude in different parts of the Sahyádrí range. Sometimes it ascends over lofty bluffs, 4,000 feet high and upwards, sometimes it descends into dips and gaps, 2,000 feet high. It is traversed in two of these gaps (the Bhor Ghát and the Thal Ghát) by lines of railway. But it never fails to be easily discernible, and it is spoken of by the hill-people as the 'Ghát Mátha.' It supplies the sources of all the rivers that flow eastwards through the Deccan. It is naturally clothed with forest and undergrowth, preserving the moisture which is ultimately to feed the river-courses with water. For the sake of these rivers, then, and of all the great interests depending on the rivers, it is necessary that the vegetation, trees, and brushwood on the ridge of the water-shed, and on the steep side on the eastern slope especially, should be most carefully preserved. The western slope may be indeed of equal importance; that however affects the Konkan; whereas it is the Deccan which we are now considering.

To some extent this preservation, indeed, exists already. Many parts of the water-shed, as above described, are included in the Government reserved forests. But these reserved forests are in some places well supervised, while in other places the supervision has become from various causes almost nominal. Some parts of the water-shed again are given out to grazing; while some few parts are occupied by a sort of rude cultivation. It should, I submit, be our object to render the supervision complete and absolute all along this limited line. The several Collectors, in conjunction with the Forest Officers, should be instructed to examine the line, as far as it lies within their several districts, and to ascertain exactly how it can be brought under the sort of supervision which is desired.

If we begin within the Deccan, from the south above the northern boundary of the Kolhápur State, proceeding northwards, that is, about the source of the Wárna in the Satara district, the water-shed line will, I am informed, be found toler-

ably well clothed with vegetation up to near the source of the Koina, the line falling within tolerably well-kept forests belonging to Government. The attention of the Collector of Satara should be specially drawn to this section of the water-shed line; and if its vegetation be as well preserved, as I understand it is, it may serve as a model for what the rest of the line within the Satara district ought to be. And as the Collector (Mr. Moore) takes a just interest in this subject, he will doubtless profit by that experience. Near the source of the Koina, and near the adjacent sources of the Yenna and of the Krishna, the water-shed line is under a sort of supervision, which, such as it is, comes under the personal observation of us all as we sojourn at Máhábleshwar. The supervision is nominally an organized affair; in practice it is very defective. Often, close to the very water-shed, jungle fires are lighted up, rude cultivation is permitted, and cattle eat down the young trees which strive to spring up. The fires can, and doubtless will, be stopped; there are other grazing places below the water-shed which can be assigned to the cattle; and by degrees the occupancy rights on the water-shed, which are comparatively few, can be bought up or exchanged for other lands. Arrangements for the better preservation of the vegetation on this section of the water-shed have already been made, and will doubtless produce results.

Next there comes, as we still proceed northwards, the section of the water-shed within the state of the Pant Sachiv, supplying the sources of the Nira and the Mutha rivers. The vegetation in this section is, I am informed, quite unprotected and for the most part destroyed, though capable of rapid restoration. For such restoration it will be necessary to make some special arrangement with the Pant Sachiv, who is under the political control of the Collector of Satara.

Then there comes the section within the Poona district, supplying the sources of the Mula, the Indrayani, the Bhima, the Ghod, the Kukari. In a part of this section the vegetation is well preserved as we all see when we pass by the railway over the Bhor Ghat. The remainder is, I hear, tolerably well preserved, though doubtless it may be much improved if the

Collector, Mr. G. Norman, will give his particular attention to the subject.

Next there is the section of the water-shed within the Ahmednagar district known as the Ankola Ghát, whence rise the streams, which virtually are the sources of the Sina. In this section the vegetation is, as I understand, well preserved, though its growth is susceptible of much improvement. If this be so, its conservancy may serve as a model to other districts.

Then follows, still in a northerly direction, the section within the Násik district supplying the sources of the Godávári and some of its affluents, also of the Girna. In this section of the water-shed the vegetation is indifferently preserved on the eastern side, as we all see when we pass by railway over the Thal Ghát. Indeed I learn that some part of this section is almost denuded. We must bear in mind that hereabouts there dwell the Bhils and other hill tribes who live entirely in the forests, and whose wants must be supplied while their rights are respected. Still, for the safety of the Násik district generally, it is necessary that the limited line of the water-shed should be left alone by the hill-people in order that it may be overspread with its growth of vegetation. If the Bhils have holdings on this limited line, they can go to other lands in exchange, either for culture or for pasturage. If the Collector will give his attention to the matter, he may by good management make some arrangement with the Bhils, whereby this particular piece of jungle may be preserved.

Lastly, there comes the section of the water-shed in the taluka of Pimpalner, in the Khandesh district, supplying the source of the Pánjra river. Here, as I understand, the vegetation is not preserved at all; the ridge itself being mostly occupied by a sort of rude culture belonging to the Bhils. But considering that other ground might be given them in exchange that the Bhils easily move about, being of migratory habits, I should not doubt that the Collector, Mr. Probert, could, by applying to the subject his large knowledge and experience, make some arrangement, whereby this limited line might be given up to jungle without any trouble being caused with the Bhils.

As regards the second point, namely, the springs, sources, and head-waters of the rivers, I have found water-springs of frequent occurrence wherever I have marched near the ridges of these mountains; and I am informed that such springs are traceable everywhere near the tops of the mountains, that is wherever the formations of laterite and trap permit the moisture to percolate from the summits and to break forth in springs of water a short distance below. I have written above '*traceable*,' because, if the surrounding vegetation is wholly preserved, the spring sends forth running water; if the jungle is imperfectly preserved, the water only oozes or trickles out; if the jungle is almost destroyed, the spring is found almost dry. The same circumstances affect similarly the head-waters of the rivers. Now, in the same manner as that already indicated respecting the water-shed line, the Collectors, in conjunction with the Forest Officers, may make local arrangements for preserving the vegetation near the sources of the rivers.

Beginning, as before, from the south, I understand that the vegetation near the source and head-waters of the Wárna is comparatively well preserved, better perhaps than in the case of any other river. Near the sources and head-waters of the Koina and the Krishna the vegetation is, as we all see, while residing at Máhábleshwar, partially preserved; but certainly the sources of the Krishna are not nearly as well protected as they ought to be in reference to the extreme importance of that river to the welfare of the country. The sources of the Yenna being almost in the Station of Máhábleshwar, are of course remarkably well preserved, by an artificial lake surrounded with woods; but after the river leaves this neighbourhood, and falls over a long rocky scarp, the vegetation near its stream is, I fear, neglected.

Then the sources of the Nira and the Mutha (in the Pant Sachiv's State), are I fear, almost entirely neglected, which is a matter for grave consideration, inasmuch as both these rivers are depended upon for the supply of water to extensive works of irrigation, recently constructed or extended.

In the Poona and Ahmednagar districts the vegetation near the sources of the Mula, the Bhima, the Indráyani, the Ghod,

the Sina, is reported to be tolerably well preserved. Still the Collectors of those districts would do well to see whether the good already done by preservation of jungles cannot be consolidated and still further augmented.

In the Násik district the vegetation near the sources of the Godávari and its affluents is reported to be very indifferently preserved. Indeed, as we all see, the low state of the Godávari river at and near Násik during the dry months affords evidence unmistakable of denudation of jungle near the source. This thoughtless wasting by the people, of the water-supply, though their neglect of the jungle, from which loss they are themselves the first to suffer, demands the serious attention of the district authorities.

The source of the Girna is somewhat better cared for, through here much improvement is required, as upon this river the irrigation works of Khandesh depend for their water-supply.

The sources of the Pánjra are perhaps less important than in the case of some of the other rivers, but they appear to be practically without supervision, and have only such vegetation (so I learn) as chance may leave to them. If this be so, then the point requires the special consideration of the Collector.

As regards the third point, namely, the top ridges and upper slopes of the cross ranges, which branch off eastwards from the main range of the Sahyádri, we all see that these must all have been once clothed with vegetation, though they are now bare. Nevertheless we know partly from general experience, and partly from special experiments, that they might be re-clothed gradually. If there jungle and vegetation were even partially restored, such restoration would improve the climate and water-supply of the Deccan, and would preserve some water in many of the affluents of the main rivers. They may be described (beginning as before from the south) as the Mula Ghát separating the Wárna from the Koina; the Máhábleshwar range overlooking the Yenna; the Pánchgani range over the Krishna; the Khámatki range bounding the Nira valley; the Sinhgarrh range near Poona; the Harischandra range forming the boundary of the Poona and Ahmednagar districts;

the Kalsubái range forming the boundary between the Ahmednagar and Nasik districts; and the Sapta Shring range north of Nasik; also the two ranges which separate the Sholápur district from the Nizám's territory on the north, and the Satara district on the south. With the exception of the Mula Ghát range, and some places in the other ranges, such as Sinhgarh and the Kátraí Ghát, they are destitute of vegetation. Yet they supply the water for the catchment areas of most of the lakes and tanks which we are now constructing for purposes of irrigation. This is notably the case with the Khámatki range and its branches which supply the water for the lakes of East Satara; and with the Sinhgarh range which supplies the water for the new tanks in the Poona district. Cultivation spreads, and must necessarily exist, up to the very base of these ranges; it generally creeps up the lowest portions of their sides. The people have grazing rights in nearly all parts of them. The Government, however, has some rights too, and there are often waste lands at its disposal. By judicious arrangements by ensuring that by rotation the people shall always have some lands for grazing and some lands for wood-cutting, while a sufficiency of jungle is preserved; by keeping cattle out of some jungle while the vegetation is young; by letting them into other jungle when the vegetation has become strong; by arranging through the Forest Department for the storage of grass for the village cattle; by taking up some occupied lands in exchange for others; by buying up some lands; by turning deserted lands into forests, and so on,—the Collectors may, with diligent and vigilant attention, be gradually able to bring under vegetation once more such portions of these hills as are important on climatic and other material considerations. The success which has followed the establishment of belts of forests along the banks of the Bhima and other rivers in the plains of the Deccan, is an earnest of what may be attained in the low ranges of hills, if the Collectors will lend their earnest attention to the matter.

I should desire to address these observations, (if my honorable colleagues shall concur in them), especially to the several Collectors. The Forest Department may do, and doubtless

will do, very much. But full success will not, indeed cannot, be secured unless the Collectors give to the forest administration the weight and the benefit of their knowledge, experience, and authority. If we are convinced of the importance of forest and jungle in respect to the matters described in this Minute, we have a right to invoke the services of the Collectors and their subordinates for the furtherance of these matters as much as for any other matters of district administration. For the general guidance of the Collectors in all these respects, we may depend on the zeal and ability of the Revenue Commissioner, Mr. E. P. Robertson.

The district authorities will, I am sure, receive all requisite assistance from the professional skill and co-operation of the Forest Conservator of this Division, Mr. A. T. Shuttleworth, and his Assistants.

The Indian Forest Act of 1878, which has just come into force in this presidency, will greatly facilitate all proceedings which may be taken in accordance with the principles which I have endeavoured to explain above.

The Collectors may, we know, be trusted to protect all private rights in the lands which may be, for the public good, brought under forest conservancy; and to arrange that all the reasonable requirements of the people in the jungles shall be satisfied.

I am aware that as our area under conservation shall increase, and as the conservation itself shall become more and more complete, additional establishments will be required. But as our forest income and the financial proceeds of our conservation shall be augmented, there will be a good case for augmenting the establishments. And I shall be willing to consider favorably and practically any proposals which my colleagues may offer in this respect.

Forest Conservancy in the Kolaba District.

Dated 7th June 1878.

HAVING recently visited the Kolaba District I have to offer the following remarks and proposals for the consideration of my honorable colleagues.

The district, as my colleagues know, consists of low hills formerly clothed with vegetation and valleys still producing excellent rice, besides other crops. It is admitted by all the local officers that there has been for many years past a considerable destruction and diminution of the spontaneous vegetation. And the rainfall, though often abundant, is not so regular as might be expected from the remarkable climatic advantages which the district possesses from its situation as a littoral tract between the sea and the Sahyádri range of mountains. Something has, of course, been done here, as elsewhere, for conservancy of the woods and forests. But it is acknowledged on all hands that much more is yet required to be done, and that a better understanding than heretofore should be arrived at between the Revenue Officers and the Forest Department as to the system which should be pursued. The introduction of the new Indian Forest Act affords an excellent opportunity for such revision. It happens too that recently Mr. Pedder, the Collector, has been collating the statistics of the district with this special view.

The Collector sets forth the classification of the several sorts of lands in the district as below :—

					Area.
Cultivated	...	...	...	...	4,71,004
Waste	...	...	...	...	39,154
Demarcated forests	...	...	...	...	53,851
Do. village forests	...	...	...	...	20,260
Rán rakshan jungle	...	...	...	...	54,129
Gurcharan (grazing)	...	...	...	...	48,084
Khájan (swamps)	...	...	...	...	20,630
Mad Bhai	...	...	...	...	1,426

As regards the first two items in the above classification, cultivation and waste, nothing need be said here. But the remaining items all come more or less under any systematic conservancy which may be established.

I therefore conferred with the Collector, Mr. Pedder, and the Conservator, Mr. Shuttleworth, and they jointly submitted the following proposals, in which, after detailed discussion with them both, I am prepared to agree; namely:—

I.—To declare as “Reserved Forests” under Chapter V., section 34 of the Forest Act, the imperial reserves already demarcated in the Talukas of Máhád, Mángáon, Roha, and Penn, aggregating 53,851 acres.

II.—To declare as “Protected Forests” under Chapter V. of the Act in all the Talukas:—

				Acres.
(a.)	The demarcated village forests	...	...	20,260
(b.)	Rán rakshan	...	...	54,128
(c.)	Gurcharan	...	...	48,084
(d.)	Khájan	...	...	21,621
(e.)	Mad Bhai	...	...	1,426

III.—As soon as possible, after the issue of the notification, the existing demarcation of forest lands, as stated above, be revised with a view to ascertain—

First.—What occupied survey numbers situated in jungle tracts should be taken up as Reserved or Protected Forest under the provisions of section 83 of the Act.

Secondly.—What lands included in No. II. above, “Protected Forests,” should be excluded therefrom and placed at the disposal of the Collector, especially with a view to being given in exchange for occupied lands that may be taken up.

Thirdly.—What portions of No. II. “Protected Forests,” above, being in excess of the area which may be determined to be necessary for the exercise of forest privileges, should be constituted “Reserved Forests,” under the provisions of Chapter II. of the Act.

IV.—The Protected Forest to be divided into working blocks so arranged as to admit of a rotation of 25 years, 10 close and 15 open. The compartments under closure to be entirely shut up; those open to be used for the exercise of the permitted privileges.

V.—The privileges, exercise of which is permitted in “Protected Forests,” where open, are declared under section 28, clause III. of the Act to be the following:—

(a.)—Grazing.

(b.)—Collecting fallen wood for firewood.

(c.)—Cutting, under the supervision of a forest official, thorns for fencing purposes.

(d.)—"Ráb" to be restricted to the collection of fallen leaves, and the cutting of "Grass" and "Brushwood" of specified kinds.

(e.)—Cutting of "Mangrove" wood for the repair and protection of sluices and embankments under the supervision of a forest official.

VI.—The persons entitled to exercise all or any of these privileges and the extent of each, and the conditions under which they are permitted, to be determined by the Collector in consultation with the Forest Department as soon as possible.

The exercise of such privileges will ordinarily be restricted to the inhabitants of forest villages, all of whom will be presumed entitled to such exercise unless their wants have been otherwise provided for.

VII.—On bringing the above system into operation, as regards each village, a detailed record of forest numbers, of the scheme of their management, of privileged persons with the nature and extent of the privileges to each, to be kept in the village papers, and the village and taluka officers will be required to make themselves acquainted with the same. Copies of these records will be supplied to the different branches of the Revenue, Police and Forest Administrations.

The compartments of each working block of Protected Forests that are to be closed to be annually notified by the forest officers to the village officers of the villages concerned, who will be held responsible that the closure is strictly maintained.

I hope that my honorable colleagues will concur with me in addressing the Commissioner of the Northern Division with a request that he will instruct the local officers in Kolaba to begin at once to give effect to the principles above laid down.

Forest Conservancy in the Poona District.

Dated July 4th, 1878.

IN continuation of the Minute of the 4th ultimo, regarding forest conservancy in the Deccan, which had the concurrence of my honorable colleagues, I would now ask their consideration to a few observations in detail regarding the Poona district.

Besides the considerations of climate and water-supply already set forth, there is, in the Poona district, a particular consideration relating to grass-supply. The cattle here are very numerous. The local pasturage is of an uncertain character; in some seasons it is very abundant, and then the people take no care to husband or to store it. In many seasons it is scanty or precarious. In seasons of drought it fails, and then the cattle often have to be sent to distant pasturage in the higher mountains, and still more often perish altogether. Nevertheless there is in the ranges of low hills, which traverse this district from west to east, enough of pasturage lands to yield a far richer supply of grass than is ever now yielded, and to provide a surplus in good years, sufficient to support the cattle in bad years. At present, as is well-known, the people have grazing rights in many of these lands into which they turn their cattle loose at all seasons. The cattle wander about, trample down the young shoots, and consume the grass in the most wasteful manner, so that little is left for seed or for reproduction. Consequently the growth of the grass is much less, and its quality is much worse than it ought to be. The animals occupy a large area, poorly stocked with grass, and get only indifferent fodder, whereas they might occupy a much smaller area well stocked with grass, and get excellent fodder: while on the other hand a considerable area would be saved, for the benefit of cattle if needed, and also for the use of man, or for the general benefit of the country.

Manifestly all this might be improved by judicious conservancy of the vegetation generally, including not only trees and brushwood, but grass also. There is every desire to afford to the people all the grass which they can claim for their

cattle, and, not only so, but also grass more permanent in its production, and more nutritious in its quality, than anything which is now obtained. The Forest Department might leave certain blocks of grass land open for a time and keep others closed for a time. When the open blocks show signs of exhaustion, they could be closed, and the cattle might be admitted into the closed blocks, and so on. Again, in many cases, those villages which have rights to grass might send their people to cut grass, and fetch it home for the cattle,—thus avoiding the need to graze the cattle, and feeding them at home instead, which change would in itself be a great improvement.

I have recently had the advantage of visiting some parts of this district in company with the Collector, Mr. Gerard Norman, and other parts in company with the Forest Officers, Mr. Shuttleworth and Mr. Wallinger. I find that the area of the district as regards forests may be thus set forth:—

Total area of Poona District	...	...	Square Miles. 5,309
Forest area sanctioned up to date	...	...	387½
Purchased and acquired during last year	...	...	3
		Total	390½

Waste and other Government lands available for transfer, and applied for by the Forest Department	279
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Total area of lands applied for and available for Forest	669
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Talukas or Sub-divisions of the District.	Total Area.	Area under Forest Department.	Waste Area applied for by Forest Department.
Junnar...	613	52	70
Indápur	569	17	15½
Khed	877	144	36
Sirur	560	4½	23
Purandhar	487	30	9
Bhimthari	1,030	29	35
Haveli	810	68	39
Máwal	383	43	51½
Total Square Miles	5,309	387½	279
Purchased and acquired during last year in Sirur, Indápur, and Bhimthari talukas	...	...	3
	Total	...	390½

The disposal of the areas, which have been applied for, has been suspended (in many cases for a very long time,) apparently until some Civil Officer (an Assistant Collector) shall be able to go over the lands with the Forest Officers. But it can hardly be necessary that an Assistant Collector in particular should perform this duty, nor can we possibly spare Assistant Collectors for the work, so many are the demands for Civil Servants of this grade. It will surely suffice that this duty should be performed by the Mámíatdár, who is the responsible native official in each taluka or sub-division of a district, and is really the deputy of the Magistrate and Collector. The Mámíatdár in most cases possesses the requisite local knowledge. If in any case he does not possess it, then the acquisition of it will be advantageous to him. The lands applied for by the Forest Department can be immediately identified by the numbers on the village maps and in the village registers. The Mámíatdár can send for the village headman and the village accountants, and can deal with the applications made by the Forest Department. This officer, seeing the importance attached by Government to the forests, would doubtless be prompt in his proceedings.

I should hope that if the Collector (Mr. G. Norman) will take this matter up with the zeal which he has displayed already in so many important affairs, it will be speedily disposed of.

But I apprehend that the sum total of the applications already made and described above will not fully meet the needs of the district according to the principles approved by the Government of Bombay in my Minute of the 4th June. I have subsequently visited some points in the great water-shed line of the ghát mountains (the Ghát Máthra), especially such points as the Másej Ghát, the Náná Ghát, and the Sakhuputra ridge, and found that while the western or Konkan sides of this line had some protection for the forests, the eastern or Deccan side was for the most part unprotected as regards vegetation, and was for the most part denuded. A detailed examination of the forest map of the district seems to show me that the points thus visited are not more unprotected than other points—in

other words, that the eastern side of the greater part of this line is without protection. While the vegetation near the sources, and the upper course of the Bhāma, the Pauna, the Mula, the Ghor, the Andra, is fairly well protected—generally with marked results—it is quite unprotected on the Kukari, the Mina, the Indráyani; and, although it is protected near the sources of the Bhima, still it is so unprotected along the upper course that in dry seasons the river shrinks almost to nothing; the drying up of this valuable stream affording an example to the people of the consequences of long-continued neglect of the natural vegetation of the country. The cross ranges running eastwards from the ghát range and traversing the district are, as we all see, bare of vegetation. I trust that my colleagues will concur with me in instructing the Forest Department to reconsider its applications by the light of these principles.

Those who study the agricultural conditions of the higher valleys, so numerous in this district, will perceive how the wonderful advantages bestowed by Nature, have not only been turned to no good account whatever, but have been gradually sacrificed by the people themselves. There are streams and springs enough to cover these valleys with irrigation all the year round. But a wretched, unproductive, unremunerative cultivation destroys the vegetation round the springs and sources, causes the soil to be washed away from rain storms, fills the river beds with silt, dries up their water-supply, and renders them comparatively useless. Consequently the agriculture is but poor as compared to what it might be.

Taking these last-named cross ranges in order, and beginning from the south, I would observe that some not inconsiderable areas have been brought under forest conservancy in the Sinhgarh range, running from Sinhgarh eastwards to Indápur, and including the Purandhar range as an off-shoot. This conservancy having been only recently introduced its results are not yet apparent, and the aspect of denudation has not yet been modified. Some further areas have been applied for. But in the direction of Indápur, or the eastern end of the range, there is much jungle land which ought to be conserved. In all the

Deccan no tract suffers more than Indápur from drought, perhaps hardly any tract has suffered as much. This is, indeed, no matter for surprise, when the bare, wasted, denuded character of the jungle lands is remembered. My colleagues will have observed that in this taluka only 17 square miles have been brought under conservancy, and only $15\frac{1}{2}$ square miles have been applied for, out of a total area of 613 square miles. Yet the survey map, and the common observation of us all, show that hereabouts there is a broad range of low hills, with numerous ramifications, now all sterile, which once bore, and might again bear, a considerable vegetation, which vegetation, if it could be gradually restored, would improve the climate and the water-supply.

Towards the centre of the range, near Sáswad, there is much jungle land belonging to Inámadars, which is now neglected, and might be conserved with advantage. Such conservancy could be undertaken only by private arrangement with the Inámadars. I would ask the Collector to use his best offices with these native gentlemen, in case they might consent to their jungles being preserved, from which preservation they would themselves be the first to benefit, while the country benefited also.

In the Bhimáshankar range, passing mainly through the Khed taluka, I was glad to find during my recent visit that much land had been brought under forest conservancy, more, indeed, than in any other part of the district, though the measure is too recent for its results to be apparent. More land, too, has been applied for. On the whole, there is hope that ere long the vegetation of this very important range will be in a fair way towards restoration. Even here, however, I apprehend that towards the eastern extremity, near Pábal, as I saw during a recent visit, some additional measures ought to be taken; and the attention of the Collector should, I think, be invited to the point.

But the vegetation on the next range, namely, the Harischandra range, is for the most part unprotected, and the arrangements for forest conservancy in this quarter (the Junnar taluka) are more backward than in any other part of the district,

During my visit, I could not but be struck by the difference between the arrangements in Khed and Junnar. The attention of the Collector should, I think, be urgently called to this point.

In my Minute of 4th June, allusion is made to the success attained in the Poona district, with the plantations of the Babul (*Acacia arabica*) on the banks of the Bhima and other rivers. These afford, not only all the ordinary advantages of forests, but also strengthen the banks of rivers, preserve the limits of the channels, prevent destructive erosion, and retain the fertilizing silt, as it passes down in the floods. But after all, when these plantations are marked on the forest map of the district, we see how small a proportion of the banks of these many rivers,—how insignificant a part of the vast river frontage, so to speak,—is covered by this most useful vegetation. There is not more than a score of miles of river bank thus planted, whereas there might be literally some hundreds of miles. For, in many places, perhaps in most places, a narrow strip or fringe of the water's side, on the slope of the bank, is at the disposal of Government, and is often leased annually to any applicant by leases, such land being known as "Pot Mallás." In many places too narrow belts of waste adjoin the rivers. In many cases again, eligible strips of land can be cheaply obtained by private arrangement. I should be sanguine that the Collector, giving thought to this subject, might obtain a large extension of the river-side plantations.

I am glad to see that some time ago the Magistrate and Collector directed his Subordinate Magistrates to be careful to inflict reasonable penalties, as prescribed by law, upon those who commit theft and trespass in the forests belonging to Government. It is expedient to warn the headmen of the village communities, whose members are known to be offenders in these respects, that it is useless to persevere in offences which are sure to be visited with condign punishment. A few deterrent examples will probably cause such offences to become rare. On the other hand, some village headmen render useful assistance and duly discharge the responsibility which pertains to them. To these men some rewards should be given, in order to encourage others to similarly exert themselves.

FOREST CONSERVANCY IN THE PANT SACHIV'S TERRITORY. 353

I propose that the Collector be asked to make a preliminary report within three months of the measures which he may have been able to adopt, and that the Conservator be also asked to make a revised statement of the reserved forests in the Poona district, under the Indian Forest Act.

Forest Conservancy in the Pant Sachiv's Territory.

Dated 4th July 1878.

DURING my recent visit to Bhor, the capital of the territory of the Pant Sachiv, a Native Chief who administers that territory subject to the political control of the Collector of Satara, I visited the sources of the rivers Nira and Mutha, and conferred with the Pant and his principal officers regarding the conservancy of his forests. It will be in the recollection of my honorable colleagues that these forests are situate near the sources of the streams which are to feed the finest irrigation works yet undertaken in the Deccan, namely, the Nira Canal with the future Batgarh Lake, and the Mutah Canal with the existing Kharakwásla Lake.

The vegetation near the sources of the Nira itself, though much injured and invaded by rude hill cultivation, still exists to some extent, and under a reasonable degree of protection might become fit to retain the natural water-supply of the river. The same remarks seem to be applicable to the affluents of the river which flow from the Ráíreshwar block of hills, and also to the important affluent, the Yelwund, which runs past the old fort of Rájgarh, and which is to feed the future lake of Batgarh.

During my recent visit to Bhor, in company with the Collector Mr. Moore, the Pant expressed to us his appreciation of the principles of forest conservancy, and his willingness to manage his forests on a system similar to ours, and to form for himself in his own territory reserved forests like our reserved forests. He expressed the same sentiments to Mr. Shuttleworth, the Conservator of Forests, whom we sent to confer with him.

I propose for the consideration of my honorable colleagues that we instruct Mr. Shuttleworth to enter into arrangements with the Pant for this purpose, under the general directions of

the Collector, care being taken to explain to the Pant that no derogation whatever is intended to his rights in the land, in the timber, in the income or other proceeds of the forests. We shall, of course, be happy to afford any assistance, professional or other, which he may require.

But I found the forest conservancy along the upper course of the Mutha to be utterly defective—so in different, indeed, as to require some interposition on the part of Government for the sake of the public interests connected with the Kharakwāsla Lake and the Mutha Canal. Similar remarks appear to be applicable to the Musa stream which joins the Mutha, just above the head of the lake. The denudation of the hill sides overhanging the streams must seriously affect the water-supply of these extensive irrigation works, and cause the flood waters to be surcharged with soil, which circumstance must accelerate the silting up of the channels and of the reservoir itself.

Some of the forests along the upper course of the Mutha and the Musa form part of the original territory of the Pant Sachiv. Much, however, of these forests belong to the British Government, and were leased to the Pant on a small annual payment, Rs. 1,800, from the commencement of our rule. They appear to have been previously leased to him by the Peishwa. The local authorities seem disposed to raise a question as to whether this lease should not either be terminated or revised. And it is but natural that such questions should be raised, regard being had to the bad condition into which the Pant or his predecessors have permitted these important forests to fall.

But before proceeding further with these questions, I propose, for the consideration of my honorable colleagues, that we direct the Conservator, Mr. Shuttleworth, to confer at once with the Pant, and to see whether some *satisfactory* arrangement cannot be made with him for the preservation of the leased forests on the Mutha and the Musa, without terminating a lease which has lasted so long. At the same time, it might be intimated to the Pant, in considerate terms, that if such arrangements should fail, we might, to our regret, be obliged to consider the rights of interposition which we may lawfully possess.

Forest Conservancy in the Nasik District.

Dated 18th July 1878.

At Igatpuri I had a conference on the 18th July with the Collector, Mr. Ramsay, the Conservator of Forests, Mr. Shuttleworth, and other local officers, regarding the conservancy of forests in the Nasik Districts. And the following conclusions were agreed upon:—

The District is divided into two parts by the Sapta Shring range of hills; the country above the range being drained into the Tápti River: the country below the range being drained into the Godávari: the river system in both cases supplying water for numerous irrigation works either constructed, or under construction, or in contemplation.

Firstly.—As regards the country north of the Sapta Shring range (excepting Talukas Málegaon and Nándgaon)—

1st.—As regards the old Báglán Taluka, now divided into the Kalwan and Satána Talukas, which comprise the sources and head waters of the Girna and its affluents, which belong to the river system of the Tápti—the Government Resolution No. 1125 of 22nd February 1876, be taken as a basis for any further improvements in forest conservancy.

2nd.—The forest reserves in these talukas are now second class reserves (*see* paragraph 1 of the Resolution): those portions which lie exactly on the water-shed line, (Ghát Mátha), and around the springs and the sources of streams, should be formed into a first class reserve from which all intrusion should be kept off: a further demarcation should be undertaken for this purpose.

3rd.—On this particular water-shed line, there are 62 villages (*see* paragraph 2 of the Resolution), in which Bhils have the right of cultivating by Dalhi one acre per family, free of revenue for a term which expires next February (1879), after which time they will be liable to charge; the opportunity should be taken of inducing them to give up this acreage in exchange for other lands in the neighbourhood, on favourable terms which the Collector could fix, accompanied, if necessary, with advances for bullocks to encourage them to change from the Dalhi to the plough

system of cultivation, as has been done already by so many other Bhils in that quarter.

4th.—The privilege of the Bhils to cut firewood for market is recognized by paragraph 4 of the Resolution: but its exercise need not be allowed within the area of the first class reserves or the second class reserves if they be situated on the water-shed or near the springs and river sources; there being still a large area of waste and jungle, where the privilege may continue to be exercised for the present, (in the manner described in paragraph 4).

5th.—Similarly the privilege of cutting "rāb" (that is wood to be burnt for ash manure) as recognized in paragraph 6 of the Resolution, should be exercised, not within the first and second class reserves, but within the waste and jungle of which there are large areas close to the villages. And the people should be instructed to collect grass, dead wood and fallen leaves, instead of cutting live branches—as has been agreed upon for the Kolāba District of the Konkan. They may not be very attentive to this instruction at first, but they will become so by degrees.

6th.—The privilege of grazing is not set forth in the Resolution, but it has been recognized in other proceedings, and certainly exists: it should not be exercised within first class reserves at all, and even within second class reserves it should be exercised in "blocks" or portions of the area, by rotation, one block being closed, and another block being opened, for grazing alternately for terms of years; even then, there will remain considerable areas of waste in which grazing is quite unrestricted.

Secondly.—As regards the country south of the Sapta Shring range, with the addition of the Mālegaon and Nāndgaon Talukas—

1st.—Revised proposals should be made by the Forest Officers in conjunction with the Collector to preserve pieces of jungle or forest near the sources of the Godāvari and its principal affluents; also on the ridge of the Kalsubái range and its principal branches.

2nd.—The privilege of cutting wood for market has been

recognized; it should not be exercised, however, in the reserved forest areas of the Talukas of Dindori, Násik, Igatpuri, Sinar, Málegaon, Nándgaon, as these areas are small as compared with the total areas of the Talukas, and as there are other waste areas where the people may continue for the present to exercise the privilege.

3rd.—In the Talukas of Chándor and Yeola, there are certain reserved forests near the towns of Chándor and Yeola, where the people now cut wood without restriction; but the vegetation is fast disappearing, and ere long there will be nothing left for any one. It is, therefore, necessary that the Forest Officers should in these forests put such restrictions on the cutting as may be necessary to ensure preservation, on such conditions as may be determined conjointly with the Collector: the Forest Department accepting the responsibility of providing firewood at reasonable prices for the markets of those places.

The only Taluka not mentioned in this Minute already, is that of Niphád which has no forests nor waste areas requiring mention here.

I should desire, if my honourable colleagues concur, to instruct the Commissioner (Mr. Robertson) in the sense of this Minute. We may rely on his exertions in this direction.

There are many other points relating to forest conservancy in this district, which points have not been touched in this Minute because they have been already settled in previous Resolutions of Government.

Forest Conservancy in the Tanna District.

Dated 19th July 1878.

ON the 18th July, at Kalyán, I held a conference regarding forest conservancy in the Tanna District, with the Collector, Mr. Jervoise, the Conservator, Mr. Shuttleworth, and his Deputy, Mr. Gibson.

There are three Konkan river systems in this district, extending from the Sayhádri range to the sea ; first, that which falls into the sea by the creek near Bassein ; second, that which

joins the Tanna estuary near Kalyán; third, that which runs into the Bombay harbour near Panwel. These Konkani rivers have short courses, indeed; but the volume of water in them is great, and the creeks near their mouths are navigable for sea-going country craft to some distance inland.

The many streams which converge on these main points and join these river systems, rise on the great brow of the Sayhádri mountains which overlook the Konkan. At first the waters are precipitated over the trap rock scarps and then are hidden in the woods which gather thick at the base of the precipices. Now these very important woods are (so far as I can see or hear) more or less preserved from end to end in this district. So far well.

But the preservation while good in some places,—as for instance near the Bor Ghát, and, as I found, at the base of the Másej Ghát—is in other places very defective and unscientific, as for instance at the foot of the Thal Ghát, near the railway station of Kasára. At this place there is an extensive forest of teak—the trees are, indeed, generally middle-sized and often stunted, still they are good and useful in their way. But the local forest officer has done nothing more than preserve the teak; all the other trees and shrubs which would naturally grow in a locality so favorable to vegetation, are cut and destroyed without hinderance. Thus the use of this great forest for preserving the water-supply is impaired, and the growth of the teak trees is retarded, as the soil, denuded of its vegetation, loses its moisture in hot weather. I learn from the •Collector that there is no reason why this forest should not be fully conserved. If so conserved, it would, in a few years, become one of the richest forests in the Konkan. There may be other cases of a like description which I have not seen; but which, if they exist, equally claim attention. Nearer the coast, in the southern part of the district, the many hills are for the most part bare of vegetation, as is seen by all who study the views from the Mátherán Hill. But in the northern part of the district the jungle is understood to be much richer and thicker.

The area of the reserved forests, already demarcated, amounts to hardly 200 square miles, which is quite small as

compared with the 4,052 square miles, the total area of a sparsely peopled district, largely covered with woods, which, if properly husbanded, would ensure, for all time coming, a plentiful supply of fuel for the markets of Bombay, but which, if left to their fate, will soon be exhausted. The Collector and the Conservator, however, inform me that the preservation of large additional areas in many parts of the district, has long been in contemplation, but has not been effected, for want of means, for making the demarcation of the limits.

I trust that my honorable colleagues will concur with me in instructing the local authorities to proceed somewhat more promptly than heretofore, with this demarcation under the general supervision of the Commissioner, so that the reserves, first class and second class, according to circumstances, may be formed in reference to the terms of the Indian Forest Act. As we cannot possibly afford to employ Assistant Collectors on this work (in the present paucity of Civil Servants) the Collector (under the control of the Commissioner) may employ any official whom he may consider trustworthy and competent for this work. Care must be taken, however, to employ adequate establishments, so that the work may be well done.

In forming the new reserves the Collector will doubtless bear in mind that the land so to be protected will ordinarily be that over which Government has control fully. But if it be proposed to take up any land in which people have rights of cultivating by "Dalhi" process, then the holders of such lands will have to be compensated.

It is, of course, important to prevent the cutting of live wood for ash-manure (ráb) within any of the reserved forests, which have been, or may yet be, formed. This ash-manure is, indeed, necessary for the rice cultivation, and for maintaining the richness of the soil in the cultivated plots. But, after the exclusion of the reserved areas, there would still remain large quantities of waste on which the people may cut the "ráb." The Collector may, by duly considering the requirements of each village, manage to form extensive reserved forests, while providing all that can properly be needed for the ash-manure. Care must be taken to prevent these orders being misinterpreted as preventing

“ráb” altogether. So long as it does not transgress the principles which we establish, it is rather indeed to be encouraged.

Doubtless the local authorities bear in mind that while the collecting of grass, dead wood, and fallen leaves, for “ráb” is very proper, the cutting of live wood, of seedlings, and the like, for this purpose is very objectionable, as being a wasteful and destructive process. While encouraging “ráb” in its legitimate form, they should carefully discourage the abuses to which it is subject.

If my honorable colleagues should concur, the Collector might be required to submit, through the Commissioner, within three months, a preliminary report on the measures he is able to adopt regarding the various matters mentioned above.

Forest Conservancy in the State of the Habshi of Janjira.

Dated 17th August 1878.

SOME time ago the Collector of Kolába, Mr. Pedder, represented to us the rapidity and completeness with which the forests of the Janjira State were being destroyed. We thereupon, with the consent of the Habshi, the chief of Janjira, caused a general examination of the forests to be made by an experienced Forest Officer, Mr. Wallinger.

I would now ask the consideration of my honorable colleagues to Mr. Wallinger's report which has been recently received.

The Janjira State (Habsan) is situated between a portion of the Kolába Collectorate and the sea; it varies in breadth from 4 to 17 miles; and stretches from 18th degree of latitude north to 18° 32' north. Its physical configuration is a net-work of low hills, ranging from 100 to 700 feet in height, and ordinarily of gentle slope. The State is divided into two portions by an arm of the sea, called the Rajpuri Creek, at the mouth of which is situated the island fort of Janjira the Habshi's seat of Government, which gives the name to the State. The area is about 350 square miles. At least one-third

of this is level land. The population is roughly estimated at 70,000, a large portion of which is sea-faring.

The staple cultivation is rice, which is grown on the flat lands, in the many wide valleys which are watered by the streams which have their sources in the up-lands. The tops and slopes of these up-lands are naturally clothed with dense woods and vegetation—though considerable inroads are beginning to be made upon them with fire and the axe. The cultivation of rice, as we all know, requires a plentiful and regular supply of water, either from direct rainfall or irrigation, and therefore in the interest of this cultivation it is necessary that the hill tops and slopes which are drained into the valleys should be kept under thick vegetation.

Indeed, the forests constitute one of the principal sources of wealth to this little State. If well preserved, they will constantly supply the neighbouring markets of Bombay, with which water communication exists. Much attention was paid to the preservation of forests and the protection of the hills by former rulers of the country. It is popularly reported that these rulers, dependent as they then were on maritime pursuits, cherished the forests as the means of building their ships and boats. The destruction of, and injury to, trees used to be punished severely. Up to 1862, the exportation of wood from the Janjira country was prohibited; in that year the present ruler of the State gave a large contract to a wealthy contractor to cut and remove for export to the Bombay market a large quantity of firewood, and since then other contracts have been undertaken. As no conditions were made with the contractors about the method of felling, and as no restrictions appear to have been imposed to prevent waste or unnecessary destruction, the forests have been almost worked out for the present. The work of denudation thus commenced has been followed up to completion by *kumri* or *dalhi* cultivation, that is, by burning the vegetation.

The territory is exposed to the unbroken force of the monsoon storms arriving from the ocean. Consequently the soil on the hill-slopes is especially liable to erosion unless protected by forest vegetation. This fact is attested by the complaints

which, as I learn, the cultivators make, that their rice lands are destroyed and their crops are swept away by the unregulated return of the rainfall to the sea.

During my recent visit to Janjira, I gathered that both the Habshi Chief and his people will be glad to see their forests preserved, though they have neither the resolution nor the organizing power to arrange such preservation for themselves.

I propose, for the consideration of my honorable colleagues, that we instruct the Collector (who is also Political Agent) in conjunction with the Conservator of Forests, to enter into negotiations with the Habshi Chief with this view. They will be careful to explain to His Excellency that all requirements of agriculture, of grazing, of wood-cutting for market and for domestic purposes, must, under all circumstances, be borne in mind; but that, nevertheless, wasteful or destructive consumption can and ought to be avoided; and a sufficiency of wood and vegetation left for reproduction for the maintenance of the supply of timber, wood, fuel, grass; for the preservation of moisture for the permanency of the arable soil. They will assure him that no derogation whatever is intended to his rights in the land, in the timber, in the income and proceeds of the forests. What we ask is, that he should manage his forests in some manner similar to that in which we manage ours; should form reserves of his own, somewhat like our reserves; should frame a brief code of forest rules, for the guidance of his people, suitable to the circumstances of his territory; and should, for all these purposes, employ the services of officials, European or Native, trained under our system of forestry. We shall be happy to afford any assistance, professional or other, which he may require. And we hope he will allow the forests to be inspected occasionally by one of our Conservators who would make a report to him. The closeness of our relations with him, and the intimate connexion of his territory with the surrounding British districts, will justify our urging this important subject on his consideration.

Forest Conservancy in the Ratnagiri District.

Dated 31st July 1878.

THE destruction of forests during the last two generations in the Ratnagiri District, the principal division of the Konkan, is generally understood to have been greater than in any other district of the Bombay Presidency. This district, which was transferred from Marátha to British Rule in 1820, was then richly wooded. The Marátha Government had always taken care of its trees and jungles. Though the agricultural classes were allowed to take wood from the forests for their agriculture, they seem not to have been allowed to take it for sale or for exportation or for any purposes save those which are domestic and agricultural. For some time these old restrictions were maintained by the British administrators.

About the year 1829, Mr. Dunlop, the then Collector, got the forests for the most part placed at the entire disposal of the people. Confidence seems to have been felt that they would regard the forests and jungles as being among their best resources, their most valued possessions; that they would use them thriftily and husband them carefully—in short would behave according to the practice of good landlords.

In fact, however, these proceedings have been popularly regarded as constituting a charter for unlicensed, unlimited, unguarded wood-cutting. The proximity to the great markets of Bombay, the facilities of communication by sea have offered a powerful inducement to the people to fell, cut and carry away. Untold quantities of Ratnagiri wood and timber have for many years past been sent to Bombay. Doubtless many rural fortunes have been made thereby.

Now, if all this had been managed reasonably, judiciously, scientifically, there would have been no objection to it. On the contrary the process is quite natural. The demand has been at Bombay : the supply has been at Ratnagiri. The forests of Ratnagiri were destined for the use of the general population. But common sense dictated that the woods and forests should be cut and thinned in a manner that leaves always sufficient trees or plants to produce seed, which, scattered and sown in,

various natural ways, ensures a constant reproduction. The Ratnágiri forests might well have been made to supply the markets and yet might have been preserved for continuous use.

Instead of this they are understood to have been cut in that wasteful improvident manner so well known as prevalent in this country—and to have been *for the present*, almost destroyed. I say "*for the present*" because I am advised that if care be now taken of the remnant of these forests, gradual restoration is possible. This possibility is worthy of consideration because the evils of the denudation are manifold—there is the loss of a large source of supply of wood for the markets—there is probably some deterioration of the climate of the district—there is a gradual silting up of the navigable creeks and estuaries which have heretofore formed the natural highways—and there is a sacrifice of natural wealth. But the matter is one of difficulty, because concessions formally made to the people, permission regularly accorded to them, cannot be withdrawn without their consent. This difficulty has been long known to ourselves and our predecessors. But an opportunity of successfully interfering has hardly arisen.

The prevailing tenure in this district is, as my honorable colleagues know so well, the khoti tenure in its various forms. It is the khotes of various degrees who acquired in Mr. Duntlop's time, and have since exercised, the privilege of wood-cutting. At the present time there is a review going on of the khoti tenures, and a number of points relating thereto are being determined. The work is carried on by the Collector, Mr. Crawford, under arrangements which will be fresh in the recollection of my colleagues. An opportunity, then, does seem to present itself for inducing the khotes of various degrees to reconsider the local arrangements about wood-cutting. If they should listen to our views on this point we might be able to meet their views on certain other points. I have consulted Mr. Crawford on the subject, and without at all pledging himself to accomplish anything, he thinks that there might be a chance of accomplishing something, and that the attempt is worth making. He is encouraged in this thought by the fact that some individual khotes are already alive to the need of

forest conservancy : and have got some reserved forests of their own. If my honorable colleagues shall concur, I would propose to instruct Mr. Crawford (through the Commissioner) in this sense. The Collector would, of course, be careful to explain to the khotes that there is no thought whatever of cancelling any concession made in past times, nor of abrogating, nor of derogating from, any right of wood-cutting now established ; that our only wish is to ensure the forests being used in a manner consistent with their preservation ; that we do not desire to obtain any profit for Government from such preservation ; that the profits of the forests will go as heretofore to those who, under existing practice, are entitled thereto ; that we aim only at maintaining the forests for the benefit of the proprietors particularly and of the community in general. The Collector should then endeavour to obtain the formal assent of the khotes to a code of forest rules, suitable to the circumstances of the district, with an agreement that there shall be some Governmental inspection to ensure these rules being observed by all concerned. At the same time I would assure Mr. Crawford that we recollect that perhaps the attainment of all this may not be practicable, and that we shall not blame him if after trial he does not succeed.

With all our administrative superiority—on which we are apt to pride ourselves and with justice—we may yet be humbled by the reflection that respecting the preservation of forests British Rule has as yet been utterly inferior to Marátha Rule in the Ratnágiri District. And in that district the forests constitute a large item of the public wealth. Such a reflection will be salutary if it shall cause us to bestir ourselves for reparation in future.

Having lately visited the Ratnágiri Coast, I will here recall to the remembrance of my honorable colleagues, the navigable streams which, rising in the ghát mountains, run a short course through the littoral tract towards the sea, then join the inflowing salt water and so form navigable creeks or estuaries—all of which streams have carried, and still carry, the trade of the district, though they are all gradually silting up by reason

of their sources and upper courses being denuded of forest and vegetation, by the destructive process described above.

I.—*Sávitri* river, joining the sea, near Bánkot—source and upper course in Kolába District—denudation utterly complete—as I have seen myself.

II.—*Wáshishtî* river, rising near Kumbhárli Ghát and passing near the town of Chiplun, from which point it is navigable to the sea which it joins near the port of Anjanwel—it is reported to show signs of gradual silting up—it has heretofore afforded the best inland navigation in the district.

III.—*Shástri* river, rising near Amba Ghát, joins the sea, at the inland bay of Jaygarh, the most promising harbour in the district. The denudation of the once-wooded areas near Amba Ghát, has been specifically reported to me as being very bad indeed.

IV.—*Muchkundi* river passes by the town of Rájápur and joins the sea near Vijiadurg. From this neighbourhood southwards past the Baura and the Phonda Gháts, I believe that the forests are in better order.

Forests in the Kolhapur State.

Dated 19th August 1878.

LAST year the Resident at Kolhápur and the Karbhari spoke to me about helping the Kolhápur State with trained establishments for conservancy of forests. Accordingly a trained Native Officer has joined them as Conservator, and is, I hear, doing work.

2. The forests towards the Southern part of the State near the Phonda Ghát are, I hear, tolerably well protected and may serve as a sort of preliminary standard for the other forests of the State. But the forest towards the Northern part of the State, towards the Amba Ghát, are reported to be undergoing a process of rapid destruction, and the denudation of that important hill tract is becoming a subject of complaint among the officers of the neighbouring British Districts.

3. There are also some hill ranges running transversely from West to East, such as the Punhala range, which have been much denuded of vegetation.

4. I would now propose to my honourable colleagues that we ask the Resident at Kolhápúr to require the Native Administrator (Karbhari) who manages the State during the minority of the Raja to furnish a detailed report of the forest reserves, both first class and second class, which are now proposed. The Resident can obtain from the Conservator of the Southern Division (Captain Peyton) any professional advice which may be required.

III. REVIEWS.

The Journal of Forestry and Estates Management.

September.—The editorial notes contain a brief account of Mr. A. E. Wild's report on the forests of Cyprus. These forests appear once to have been of great extent, but now to have been destroyed till nothing is left but some tracts on the chain of hills running east and west, the better growth being confined to the more inaccessible localities. Around villages and in places suitable for transport, the woodland has been so destroyed that it no longer deserves the name of forest. Fires caused by shepherds and others have here, as elsewhere, gone hand in hand with indiscriminate felling to ruin the estates, and an excessive tapping of the *Pinus laricio* for resin has added yet another destructive agent to the list.

The report itself has not reached India. The editor, however, reproaches Mr. Wild with not describing the general aspect and extent of the forests, and the height, bulk and mercantile value of the different kinds of trees. Mr. Wild was sent, it would appear, with little or no assistance, and with only a very incorrect map; and it was not possible for him to do more than he did.

Mr. Burrows gives a sketch of the "History and Management of the New Forest," which is well worth reading. It is the history of an estate which might be most valuable, but which has been bungled over, wasted and neglected, because no one seems to have had any clear idea of the fact that no forest estate burdened with private rights can possibly be managed efficiently till those rights are all settled and defined authoritatively by power of law, and then those that are incompatible with the preservation of the forest, commuted, or bought out, or disposed of by some such system as is familiar to French foresters under the name of "Cantonement."

There is a brief notice of an accidental discovery of a process for preserving wood from decay. A mixture of coal tar and

ashes (wood ashes?) applied has the desired effect. This is quoted from a German periodical, *Landwirthschaft und Industrie*.

Then comes a paper on "Selling Timber," the point being felling the trees and then selling, or selling the trees to be cut, standing. A good many useful facts are stated: the paper, however, does not apply to natural forests where large quantities may have to be sold, and the felling of which may be very costly.

In Germany, the "coupes" are sold after felling, and, we believe, conversion in many cases.

In France, an admirable system has been now perfected, of selling *par pied*. Such a system is the result of slow development. The terms and conditions are necessarily strict; the penalties for injuring other trees and for cutting a tree not marked as belonging to the "coupe" are severe. It takes a long time before people get accustomed to this; but after much patient perseverance, the result has been, in France, that there has grown up a class of perfectly respectable and reliable timber merchants, well experienced in valuing the stock, and knowing what to bid for it, having had local experience of the average character and quality of the timber of a given forest. These persons never think of infringing the forest law, or exceeding the conditions of sale; they are a tower of strength to the forest officials, and all initial expenditure by the State on exploitation is avoided.

A paper on "Pruning neglected Trees," by Mr. Angus McIntosh, may be studied in detail.

A long account of an excursion of the Scotch Arboricultural Society contains many pleasing passages, but is dragged out to a weary length by the insertion in detail of all the twaddle talked after dinner by these good people in proposing one another's health.

Please also read a charming "Romance" of how Jus-sieu carried home a cedar of Lebanon in his hat, to the "Jardin des Plantes" and of his adventures on the way.

October.—A paper on the different formation of the male and female flowers of pines may be read. The contention is, that female flowers are modifications of a *branch*, and the male flower a modification of a leaf or rather of a bundle of *leaves*.

Dr. Brown has also translated the paper which some of our readers may have noticed in the "Revue" (April 1879) on the Forest Reforms effected under Colbert.

November.—There is a paper of a very elementary nature called "Science for young Foresters," by Mr. Pluckley; this may be usefully read by beginners. It gives a brief account of the chief elements in soil composition, but there is nothing that is not as well told in Mr. Tanner's little primer "First Steps in Agriculture."

The Scottish Arboricultural Society naturally occupies a large share of space and attention of this journal, and here we have the president's address. Mr. Adam, M.P., made a brief, very commonplace, and by no means interesting, address. The only thing worth repeating, which he said, was, that a school of forestry in England was much wanted. This nobody will deny, but further he "thought that looking at *the area* possessed by Government, in *the Botanic Gardens*, Edinburgh, a school of forestry might be established there, where *all* the operations of forestry* might be practised and taught, and where young men might learn as much as in Germany or France." This statement, it is noted, was received with "cheers." Were they derivative?

The following is Mr. Buchan's report on his meteorological observations :—

"Mr. Buchan reported that during the past year he had to some considerable extent discussed the observations that had been made at Carnwath since the previous report was given in by the committee. These observations consisted of two sets,—one conducted in a situation clear of trees, and *the other* was* quite open to the sun, wind, and weather. The other set was made with thermometers kept completely in the shade, so that at no time of the year could the sun shine on the ground immediately around the thermometers. Further, the two sets of instruments were distant from each other only about thirty yards, and they were in every respect comparable as regards position, &c., excepting that one was fully exposed to the sun, and the

* The italics are, of course, ours.—ED.

other quite shaded by the trees. The more important of the results were those which refer to the mean temperatures of the soil, from which it appears that the soil under shade was about two degrees colder than the soil fully exposed to the rays of the sun, the depths in each case being three, twelve, and twenty-two inches. It was evident, therefore, that soil closely shaded by trees from the sun has a temperature greatly lower than soil exposed to the sun; and when the results are looked at in connection with the extensive observations made on the subject for some years in Germany, the relative deficiency of the temperature of the soil shaded by trees is considerable during the summer months. In one of the months over which the observations extended the mean temperature of the soil shaded was four degrees lower than that of the soil exposed; and the distance between the two places was only thirty yards. The importance of the whole question in its relation to the presence of underwood and other vegetable coverings inside the wood, and the temperature of the soil about the roots of the trees, was suggested to the members as being well worthy of their best consideration, chiefly with reference to the practice of arboriculture. As regards the temperature of the air at the two situations so near each other, the observations showed that the mean temperature of the air in the shaded position was half a degree colder than in the position fully exposed to the influence of the sun's rays; and Mr. Buchan was of opinion that still greater differences would probably be found to obtain if the observations of the shaded thermometers were extended further into the wood than had yet been done at Carnwath. The general result of the whole series of observations made at Carnwath, in addition to the others already stated, with reference to the influence of forests upon climate, were stated briefly as follows:—The mean temperature inside woods is greater than that outside during the whole year, except in autumn. In the spring and early summer the air inside woods was both warmer and moister than outside; and during autumn the excess of moisture inside woods is very greatly increased, and this result has been confirmed during those months of the period when the weather has been unusually damp. In conclusion, Mr. Buchan intimated that he proposed,

as time and opportunity might permit, to contrast somewhat in detail the influence of strong winds and calms; the influence of clouded and clear skies, sunshiny and clouded weather; of periods of intense short continued cold, long continued cold, continuous rain, and continuous drought. He would indicate the results of these to future meetings."

We note from the Society's proceedings further that Mr. John Fergusson, Deputy Conservator of the Nilambur Forests, Madras, gained the Society's gold medal, for a report of the natural forests and cultivated plantations of the——presidency (*sic*), presumably Madras is meant. If this report really describes the natural jungles, (and not only the Nilambur teak plantation,) under the administration of His Grace of Buckingham, it must be well worth reading.

But Indian Forests, their administration, and their literature are subjects far below the notice of the 'Journal of Forestry,' and so one presidency is very much the same as another—all are blanks, to this enlightened advocate of Forest Science.

Then comes another account of an excursion of the Scottish Arboricultural Society. Fortunately, this time there was no dinner, and "when the shades of evening began to fall" the company "wended their way" through the beautiful grounds towards Dalkeith, and were able to get to "their respective homes" by the evening trains.

Those who read Mr. McIntosh's paper on Pruning should also notice a letter regarding it by *Quercus*.

There are many other notes in this number, but chiefly British in their interest and value.

The Game Birds of India.

WE wish to draw the attention of our readers to Messrs. Hume and Marshall's "GAME BIRDS OF INDIA,"—a book which cannot fail to be of the greatest interest to forest officers, whether they are devotees of the gun or not. To these who have opportunities for sport, and whose districts contain much feathered game, some of the species of which, especially water birds, are often difficult to make out, the book will be almost indispensable, while to

those who find but little time or opportunity for shikar, it cannot fail to be most interesting, for they will surely want to know something of the names, habits, and distribution of the birds they meet with in their jungle tours.

The great drawback to the book is its expense; but our readers may be sure that in the beautiful plates and complete descriptions they get their full money's worth. It may not generally be known that the work has not proved a paying transaction for the authors. We believe that even if they succeed in selling every copy they publish, they will still be losers by it; and we have no doubt that many of our readers, most of whom know the kindly secretary who so long presided at the head of our Department, and so long interested himself in Forest Officers and their work, will help him to make the sale of his splendid book as little of a losing speculation as they can. We have seen the first volume, which contains the Bustards, Pea-fowl, Pheasants and Jungle-fowl, and we have been delighted with the get-up of the plates and the fullness of the descriptions.

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[No. 4.

Herr Burckhardt, Forest Director.

WE have received the melancholy intelligence of the death of one of the most experienced and distinguished forest officers in Germany—Heinrich Christian Burckhardt, Forest Director of the province of Hanover, in Prussia, died on the 14th December last. Last year he celebrated the anniversary of his having entered the Forest Service of his own country fifty years ago, and in little more than a year after his jubilee he was called away from a life which was active to the very last. He was born in 1811, and was only sixty-eight years old when he died.

Burckhardt was not only a most skilful practical forester, but was equally distinguished as a writer. His books and numerous minor publications are all singularly well written. The subjects handled by him are set forth in a most lucid, and at the same time in a most pleasant style, which cannot fail to engage the attention of the reader. His great work on Sylviculture, "*Säen und Pflanzen*," has seen many editions, and will not readily be forgotten. During the last fifteen years of his life he published a series of papers on a great variety of subjects connected with Forestry, in a periodical publication which he called *Aus dem Walde*, or *Communications from the Forest*.

For many years at the head of Forest Administration in the Kingdom of Hanover, he remained in his position after the annexation of the country to Prussia. Though personally much attached to the late reigning family of the house of Hanover, he was much liked and greatly honoured by the German Emperor and the Crown Prince, for whom he arranged many a royal hunt.

Burckhardt was one of the keenest and best sportsmen of his time. He was a delightful companion, and there were few

greater pleasures than to be with him in the forest and to accompany him on his tours of inspection. Forest administration in Hanover owes its present excellent condition in a great measure to his long-continued influence at the head of the service. Many new methods of silviculture were initiated by him, the chief being the planting up, principally with Scotch Fir, by means of the steam plough, of the vast extents of barren heath which are found in the district of Luneburg and in other parts of the province. But his great merit as an administrator did not consist so much in the new and perfected methods of silviculture which he introduced, as in his methodical and yet practical management of all matters relating to the general administration of the forests in his charge. Quick and determined in his decision, he yet let everybody, as far as could be done, work in his own way, and he always allowed ample time for the gradual development of new administrative measures. The administrative skill and method which Burckhardt brought to bear upon his work was something totally different from what now-a-days is often mistaken for administrative skill and energy. Burckhardt was satisfied with the slow and steady growth of a good organization: he did not build one reform upon the top of the other; nor did he indulge in rash measures and in constant changes.

Burckhardt's great administrative power was fully recognized by the Prussian Government after the annexation of Hanover, and several attempts were made to induce him, by offers of great and substantial advantage, to take a part in the general administration of the Forest Service in Prussia. But he preferred his old and more limited sphere of usefulness, and Government yielded to his wish in a manner equally honourable to him and to Government. Thus he continued to control the system of steady progress which he had initiated in Hanover.

Burckhardt's personal influence over the officers subordinate to him was singularly great, and it was based upon feelings of mutual respect and of devoted attachment to him on the part of the younger officers.

A considerable proportion of the young Englishmen who were

prepared for Forest Service in India on the Continent of Europe, between 1867 and 1873, were educated in Germany under Forest Director Burckhardt's control. The arrangements made in Hanover were necessarily different from the arrangements which had at the same time been made with the French Government for the education of young Englishmen for the Indian Forest Service at the French Forest School of Nancy. The point was this,—that in France a course of two years was at that time sufficient for French students to pass the State Examination for the superior branch of the Forest Department, while in Germany five years are required for this purpose. English students could not be expected to devote so long a time to their professional education on the Continent, and thus it became necessary to devise for those educated in Germany a curtailed course of study. Thus, while the English students at Nancy were compelled to pass the same examination as the French students, and to attain the same standard of professional skill and knowledge, it could not be expected from the English students, studying in Germany, that they should pass the much more difficult examinations required from German students. Hence the arrangements made with Forest Director Burckhardt for the education of our English students were necessarily of a less complete character than the arrangements made in France, and in 1873 it was decided to concentrate the system of professional education for the Indian Forest Service entirely at Nancy.

But those who were educated under Forest Director Burckhardt have learnt much, and have most of them turned out good practical foresters in India. They doubtless remember with pleasure the time spent under his control, and many of them will grieve over his loss.

Burckhardt was not only an excellent sportsman, a popular administrator, and a pleasant writer, but he was a scholar, and several Universities in Germany honoured him by granting him their degrees of Doctor in Law and Philosophy. He took a keen interest in public affairs, and was honoured and beloved by a large circle of friends.

D. B.

Cinchona Cultivation in Java.

By DR. G. KING, *Superintendent, Royal Botanic Gardens,
Calcutta.*

IN accordance with the orders of Government I proceeded in August last to Java to inspect the cinchona plantations of the Dutch. Government is aware that, although it is from the species known as *Calisaya* that the most valuable of all the medicinal cinchona barks are obtained, the cultivation of this sort has not hitherto been so successfully prosecuted in British Sikkim as has that of *Cinchona succirubra*. *Cinchona Calisaya* is found to be in Sikkim (as has been explained in several of my annual reports) a very variable species, and its variations are not confined to the form of leaves and flowers, but extend also to the chemical constitution of the bark, that of some of the varieties grown in Sikkim containing nearly eight per cent of pure quinine, while the bark of others yields very little of quinine or of any other useful alkaloid. But the differences in external form and of richness in alkaloid are not related to each other in any very definite way, and trees of which the leaves and flowers are so much alike as to be undistinguishable from dried specimens have been found to yield bark of quite different chemical composition. It had for some time been known from the official reports on their plantations in Java that the Dutch have in cultivation there a variety of *Calisaya*, the bark of which is richer in quinine than any bark ever imported from South America; some of the Dutch samples having yielded on analysis the extraordinary amount of 13·7 per cent. of quinine. The object of my visit was to see exactly what this variety is, and by spending some time in the plantation, to learn what the conditions are under which it has been so successfully cultivated. Before leaving India I was furnished with a letter of introduction from His Excellency the Viceroy to the Governor-General of Netherlands India, and I have to acknowledge the courtesy and kindness which I received from the Dutch authorities, by whom every facility was afforded to me for travelling in Java and for inspecting the Government plantations.

The cinchona plantations of the Dutch Government do not, as in Sikkim, form a compact belt, but consist of seven distinct and separate estates scattered over a range of volcanic hills in the centre of the island. These estates range in altitude between 4,000 and 6,400 feet above the sea-level. In all of them the soil is of a dark-brown colour, light and friable, very pervious to water, and almost free from stones. The surface soil is uniform and in general deep (in some places it reaches a depth of 12 to 14 feet), and is rich in vegetable matter. The sub-soil is lighter in colour from the absence of humus, but has similar physical properties. Both surface and sub-soil have as their basis decomposed trachytic rock rich in potash, and they were recognised by Hochstetter (an eminent German geologist familiar with the volcanic regions of the Andes, and who recently visited Java) as almost identical with the Andesite formation of the Cordillera on which cinchona is indigenous. The slopes of the hills on which the plantations stand are so very gentle that washing of soil is very slight, and landslips are almost unknown. The drainage water finds its way underground to the larger streams which separate the ridges. The absence of small superficial drainage channels is quite a feature in the country, and illustrates well the great permeability of the strata. The natural vegetation in these hills is very like that at a slightly lower elevation in Sikkim. The climate is, however, greatly different from that of Sikkim. At Tjinircean (5,100 feet above the sea) the temperature at 6 A.M. all the year round ranges from 50° to 59° Fahrenheit, except during the two dry months, when it occasionally falls as low as 44° Fahrenheit. The highest temperature during the day is 73·5° Fahrenheit. The mean average over the whole year is 53·5° Fahrenheit, while the constant temperature of the soil at five feet from the surface stands all the year round at 64·04° Fahrenheit. The rainfall for the year varies at the different estates from 120 to 140 inches. The rainy season *par excellence* extends from November to June. Of the remaining four months, August and September are the driest. But there are very few days absolutely without a shower in the afternoon. The rain falls at all times very gently, and violent storms and floods are very rare. It is only during

the early part of the rainy seas on that rain falls during the early part of the day; at other times it falls chiefly in the afternoon. The climate is a remarkably even one, and the weather for the day can be predicted every morning from the temperature about sunrise. Experience at Tjinircean (the chief Government plantation) has shown that if the thermometer at 6 o'clock A.M. stands at or below 54.6° Fahrenheit, no rain will fall during the day. If it stands at 55.4° Fahrenheit, rain in the afternoon is probable; if at 57° Fahrenheit, rain in the afternoon is certain; while if it stands at 60.8° Fahrenheit, rain will surely fall before noon.

All this forms a strong contrast to the state of matters in Sikkim. There the basis of the soil is decayed primitive rock (gneiss and mica schist) poor in potash; the surface soil, although rich in vegetable matter, is very irregular in depth, is occasionally very stony, and is everywhere ploughed up into small channels for the transmission of superficial drainage. The sub-soil is stiff, cold, and little permeable to water. In Sikkim the contrast between the temperature of day and night and of summer and winter is great, and the rainfall, although about of the same volume as in Java, is so distributed over the year, that while for seven months everything is saturated with moisture, during the other five hardly a shower falls from the clouds.

The fertility of volcanic soils is proverbial, and the partiality of the medicinal cinchonas for such soils, as well as for a cool equable climate where the rainfall is well distributed over the year, has been testified to by all the collectors who have explored the regions of the Andes where they naturally grow. It might be anticipated therefore that in Java cinchona would thrive well, and specially so as the Dutch are known to be excellent cultivators; and their success has as a fact been great. I have no hesitation in saying that all the species of cinchona are to be found in greater perfection in Java than in Sikkim or the Nilgiris, and (judging from what I saw of their cultivation in that island some years ago) I believe I may also say than in Ceylon.

In Sikkim we have, however, the advantage of much cheaper

labour than in Java. The expenditure on the Dutch plantations for the year 1877 (the latest for which returns have been published) was fifty-seven thousand guilders (a guilder is about the same value as a rupee), and in 1876 it was forty-five thousand, the number of plants, including nursery stock, being 2,150,000. In Sikkim, on the other hand, the plantation consisted in 1878-79 of 4,881,055 plants (nursery stock being included), and the outlay for the year was Rs. 64,000.

The cinchona trees, of which the bark has yielded the Dutch such a high percentage of quinine, have all been raised from a parcel of seed purchased in 1866 by the Dutch Government from an English collector named Ledger after our own India Office had declined to buy them. These seeds were got by Mr. Ledger from a half-caste collector, who would not tell where he collected them, and who was murdered soon after. The exact locality in Bolivia where they were gathered therefore remains unknown. Mr. Ledger's seed produced 6,300 trees, which have in late years been largely propagated from. Although these trees differ considerably among themselves in shape and size of leaf, in colour of midribs, nerves, and under-surface, and although the bark of individual trees (in so far as it has been analysed) varies as to the amount of quinine contained, the majority agree in being much richer in that alkaloid than any other known variety or species of cinchona. The name *Ledgeriana* was originally given by the Dutch as a plantation name, to distinguish the produce of Ledger's seed from that of the seed collected by others; but as the points of agreement, both anatomical and chemical, between individual trees so originating is greater than their points of difference, it is quite warrantable to retain the name as that of a very distinct variety of *Calisaya*, if not indeed of a distinct species of cinchona.

The 6,300 plants raised from Ledger's seed (which are now thirteen years old) all agree in being rather shabby-looking trees, averaging in height 25 feet, and girthing at 6 feet from the ground twenty-seven (27) inches. They have tall stems and rather small, lax, conical heads, the branches of which are more or less distinctly arranged in tiers. The leaves of the

majority are long and narrow, for the most part green, but very often with a tinge of red in the footstalk, midribs, and nerves; while those of a few are of an uniform deep purple colour on their lower surface. The mature leaves of all agree in being quite free from hairs. These trees flower much later in life than the other cinchonas; the flower panicles are small; the flowers, which are very sweet-smelling, are more or less drooping, of a yellowish-white colour, with a tinge of green in the tube, which is short, wide, and inflated at the base. In the majority of the trees there is a total absence of red in the flower; one, however, of the very richest quinine-yielders has its flowers slightly tinged with pink. The seed-vessels are small, short, and almost globular in shape.

The Dutch mode of cultivation is similar to our own. The only method which they adopt, and which we have not hitherto tried, is that of grafting *Ledgeriana* on *succirubra* stocks, and this plan I shall at once ask Mr. Gammie to try. The Dutch have devised a new way of taking the bark crop which they are very hopeful about. It consists in shaving off the greater part of the bark of a living tree to a height of eight or ten feet from the ground, taking care to leave everywhere a sufficiency to cover the wood. It is found that in Java a tree so treated gradually renews its bark, so that in the course of from twelve or twenty months the renewed bark is as thick as the original. This method is far less likely to injure the health of the trees than Mr. McIvor's plan of stripping and mossing, which, after extended trials, has been finally abandoned by the Dutch. The conditions are so different in Sikkim, the lives of individual trees being much less certain than in Java, that I am not sure that the shaving plan can be very advantageously worked in our plantations; but I shall ask Mr. Gammie to give it a trial during the present barking season.

I have already stated that the trees of *Galisaya* in the Sikkim plantation present great variety in form of leaf and flower. The barks of all these varieties were submitted to Mr. Wood for report, and his analyses showed that, while some of them were very poor in quinine, others contained as much as six and seven per cent. of that alkaloid. The

Calisaya trees in our plantation were obtained at different times and from various sources. A few of them were raised from a pinch of Ledger's seed obtained at second hand from the Nilgiris. And I have much satisfaction in informing you that, after seeing the Java *Ledgerianas*, I have no doubt whatever that our three or four best kinds of *Calisaya* are precisely the same as some of the forms of *Ledgeriana* cultivated by the Dutch. It is true that none of the *Calisaya* barks grown in Sikkim contain so much quinine as the best forms of *Ledgeriana* grown in Java, but this I believe to be an affair of climate and soil. All the Java cinchonas are richer in alkaloid than those of Sikkim, and this will, I believe, always be the case, the physical conditions being so much more favourable in that island.

Ever since Mr. Wood's analyses showed the excellence of some of our forms of *Calisaya*, every effort has been made to propagate these artificially, experience having shown that they do not come true to seed. Now that I am satisfied that we have in Sikkim the true Ledger *Calisaya*, I am more strongly than ever of opinion that we should go on increasing the cultivation of it as much as possible. I do not anticipate that we shall be able to grow it quite so cheaply as *succirubra*, or that we shall be able to produce bark of such high quality as the Dutch. But the object of the Indian Government is not to grow a very fine bark for the European market (which is the object of the Dutch), but from the yield of its plantation to produce a good and cheap cure for fever. And even in Sikkim, where the climate and soil are not so suitable as could be desired, I believe we might grow a bark rich enough in quinine to enable us to turn out pure quinine at probably two or two-and-a-half rupees per ounce, which is less than the price of the London quinetum (a preparation made in imitation of the Government cinchona febrifuge) and greatly below the market-price of quinine.

I have no doubt that a more suitable locality for cinchona cultivation than Sikkim could be found further south. The cinchonas in South America are never found further north than 10° nor further south than 20°. Favourable spots might

be discovered in Burma, perhaps in the Andaman Islands, and possibly in the Khasia hills. Such spots should be searched for. In the meantime the conditions in Sikkim appear to me to be sufficiently favourable to promise a moderate success and to warrant considerable extensions of our plantations of yellow bark there. To carry out these it may be necessary to ask for a slight increase in the annual grant for the present plantation; but as that is now being worked to a considerable profit, I hope, when necessary, an additional grant may be allowed.

The Dutch Government has hitherto manufactured neither quinine nor cinchona febrifuge from its bark, but has consigned the annual crop to Amsterdam for sale. Of late a few pounds of febrifuge have been made as an experiment at the Medical Depôt in Batavia,—the process followed being that of Mr. Wood, and the product being undistinguishable from his.

Fire Conservancy in Sal Forests in the Eastern Duars.

It is now admitted that successful fire conservancy is at the root of all improvement of the deciduous forests in India, and this is especially the case with sâl forests, which, owing to excessive fellings, have become filled with a dense undergrowth of grass, and this grass dries up and is burned annually, and causes the greatest injury to the forest growth.

In the north of India, sâl forests extend, from the Upper Jumna, at an elevation of about 2,500 feet, along the foot, and in the valleys of the Himalayas, to the Boroli river in Assam, beyond which no sâl has hitherto been found. Sâl only thrives on well-drained soils, and on the north bank of the Brahmaputra river no sâl forest exists, from the Gabharo Ai river in the Eastern Duars to the east of the Manoiri river ; where small patches are found extending along the west bank of the Boroli river, from the hills towards the Brahmaputra.

Its absence, here, for a distance of over 200 miles, appears to be due to the predominance of clay in the soil.

Sâl forests also extend along the northern slopes, and in the hills of Central India and Chota Nagpore, and the Garo and Khasi Hills.

In Assam, fire conservancy is needed for the pine forests of the Khasi and Jynteah Hills, as well as for the sâl forests, but the great masses of Evergreen forests in the province do not suffer from jungle fires.

The Sissu and Khair forests of the Eastern Duars seem to spring up vigorously, in spite of the severest jungle fires, and the principal danger to which they are exposed is from the constant shifting of the beds of the mountain streams, which carry off the forest before it has time to attain maturity.

Leaving the general question, however, I wish to confine my remarks to the sâl forests of the Eastern Duars, and the Goalpara and Garo Hills districts, with the management of which I have been entrusted for the last four years.

Fire conservancy has, for its aim, the eradication of the grass now forming the undergrowth of the sâl forests, by protecting them from the annual jungle fires, and allowing the forest to grow up densely, and thus take complete possession of the soil.

From the aspect of some patches of virgin sâl forest in the Garo Hills, and of a tract called the Janagaon Jhar in the Eastern Duars, as well as from the condition of patches of sâl forest growing here and there near villages throughout the Goalpara district; I believe that this grass has sprung up in the forests owing to excessive fellings, and jhumings, or cutting down and firing tree jungle, principally for cotton cultivation, and that it is no necessary accompaniment of sâl.

Last year I came upon a splendid tract of sâl forest at Dambu, in the Garo Hills, just on the watershed between the Brahmaputra and Surmah river systems.

In this tract, extending over several hundred acres, and situated on an inclined plateau winding between the hills, the soil being a deep sandy loam, the sâl trees die naturally of old age, and fall to the ground after attaining a girth of 15 or 16 feet, and a length of stem of 90 feet to the first branch, and 120 feet to the summit.

Masses of these huge sâl trees, with their crowns touching as they are wafted backwards and forwards by the wind,

grow over fan-palms and bamboos, and short feathery grass and ferns.

Here we also find dense young high forest, poles and saplings, with an occasional monster tree still standing, whilst its coevals are lying prostrate on the ground, amongst the young growth; huge masses of sound sâl heartwood, but too removed from ways of communication to be utilized.

The laborious Mech woodcutter has felled all the large sâl trees to within six miles of these forests, but has not yet penetrated into them.

His steps are everywhere followed by the Garo cultivator, who leaves the huge trees alone, but fells everything left by the Mech, and burns up the wood for his cotton fields, only too glad to find virgin soil partially cleared by other people's labor.

He lops off the branches and leading shoots of any large trees the Mech may have left; and these perish eventually in the fires, in the dense grass and reed jungle which springs up on the site of the sâl forest, when the Garo has abandoned it, after his two years' crops have been harvested.

The Janagaon Jhar in the Eastern Duars is a tract of about 60 square miles of sâl forest, which has escaped cotton jhuming—the common fate of sâl forests under the Bhutea rule, owing probably to the shingly and poor nature of the soil, and the absence of water in the dry season, as it is situate in the Nepani, or waterless region of the Terai; where the water runs under ground, except in the rainy season.

Trees of four and five feet girth here are abundant, and the forest growth is dense and tall.

The larger trees have been felled by wood-cutters in the Bhutea days.

There is scarcely any undergrowth, except ferns and stunted creepers, and a light feathery grass, called locally *Hatoroa bun*—the obnoxious coarse grass, called *Batha bun*, only occurs here and there in patches, and not, as in other sâl forests growing everywhere densely under the trees. A portion of this forest is called Gua Bari Jhar, from the sâl growing as closely as a clump of Gua or Tamil trees in a village.

A great part of the Janagaon Jhar can be traversed on foot, or on a pony, without greater difficulty than arises from the numerous stems of the sâl trees.

In all our reserves in the Eastern Duars, patches of high forest poles and saplings exist, of a similar dense growth and free from *Batha bun*; but nowhere to such an extent as in the Janagaon Jhar.

In the Goalpara district, the zemindars, who own princely estates, have always levied a revenue on sâl timber; as well as the Bhuteas in the Eastern Duars, which were annexed by the British Government in 1864.

The villagers therefore, however they might jhum in remote places, have always respected the sâl trees near their villages, whence the larger trees have been for the most part removed by the wood-cutters, who paid revenue to the proprietor of the soil.

We find, therefore, patches of dense growing sâl poles and saplings; and even of high forest, near the villages and rice fields on both sides of the Brahmaputra.

The villagers beat down the grass in these patches of sâl in the rains, and burn it as soon as it is dry enough, when very little, if any, damage is done to the sâl.

The grass is, moreover, grazed down by the cattle, and rooted up by the pigs, which do not eat the sâl seedlings. It is thus destroyed, and the growth of the forest becomes as vigorous as it was intended by nature to be.

Any observer would be at once struck with the contrast afforded by the silvery and red barks, the dark green foliage, the clean cylindrical stems, and spire-like summits of the sâl in such patches; with the charred bark, covered with small branches also frequently charred, the flattened summits, and the scanty and lighter colored foliage of the trees in an annually burned sâl forest.

I have heard it remarked that the soil of the Eastern Duars is too sandy and poor to produce fine sâl forests; but in opposition to this is the fact, that the Janagaon Jhar, where the soil is poorest and driest, now contains the best sâl forests in the district; and the magnificent virgin sâl forests in the Garo Hills, are situated on a soil formed by the disintegration of the hard-

est quartzite with gneiss and mica schist, which can only yield a very poor soil.

This remark was made specially with reference to the Sidli reserve, a sâl forest of fifty square miles, where fires have been excessively injurious; and the forest, in consequence of their annual occurrence, deteriorates rather than improves, in spite of all fellings having been stopped for the last fifteen years.

But even here are a few fine sâl trees which are models of vigorous growth, and there are stumps of large trees concealed everywhere by the grass.

The grass in the sâl forests in the Eastern Duars varies in height from three or four feet in the poorer soils to eight or ten feet in the deeper ones; and through such grass an elephant will plough his way when ridden, at a rate not exceeding one mile in an hour; and this is the only way that such forests can be inspected unless they be burned.

The mass of the grass is of the species commonly used for thatching in the settled districts of Bengal, where fields of it are reserved for the purpose, and it there grows to the height of only three or four feet.

It is called *Batha bun*, locally. From the preceding facts it must be admitted that this grass in its present state has invaded the sâl forests, owing to excessive and unregulated fellings; and especially to the extensive cotton jhuming, for which young sâl forest was especially adapted, as it is much more easily cleared than any other forest; besides, the stems of the trees felled make an excellent palisade to keep out wild animals from the crops.

The eradication of this grass, and the restoration of natural conditions for the growth of sâl, are therefore the first objects to which a forester will direct his attention. But to ensure these objects, fire must be kept out of the sâl forest, so that the growth of the sâl and other trees may keep down the grass, and eventually take sole possession of the soil.

We should here listen to the arguments in favor of burning the jungle, which are strenuously brought to our notice by the protectors of the Indian cultivator. The dead grass in the dry season is hateful to man and beast,

the heat and glare from it in March and April are intolerable. The sportsman cannot find his game until the grass be burned, nor the cattle their grazing. The villagers cannot move about to collect house posts, or dead wood for fuel, and timber felled can only be removed with difficulty.

With high jungle standing near his huts and crops, the villager sees his cattle carried off by tigers, and his crops ravaged by elephants, buffalo, and deer. He is also exposed to the danger of losing all his buildings, if the adjacent forest were fired during high winds, which will often carry masses of blazing grass for several hundred yards.

A notice was once circulated throughout Assam, forbidding any one to fire grass without taking steps to confine the fire to a certain area, and to extinguish it as soon as this had been burned. An annual statement was also compiled in each district showing the damage done by jungle fires, which was estimated in lacs of rupees; but this notice speedily became a dead letter. The masses of grass are too extensive, and the population too scanty for such measures to be carried out.

The owners of property threatened by fire, whether buildings, crops, tea gardens, or forests, took the usual precautions of burning all grass lands adjoining their property early in the season, or they suffered accordingly in case of neglect.

Thatching grass, which on account of its abundance in Assam, has no intrinsic value as yet, was included in these returns; but that required for local purposes is always cut before the grass is sufficiently dry to burn readily.

I will here give a short account of the rainfall and prevailing winds in the district, on which the burning of the grass depends, and also of the labor available for forest work. The average annual rainfall at Goalpara is 98.75 inches, and this is probably exceeded in the Eastern Duars, which are nearer the hills, but statistics for them are not available. The monsoon commences about the middle of May and lasts till the middle of October. There is also, generally, cloudy weather with some showers from the latter part of December till the middle of February, but this cannot always be depended on.

Heavy nightdews occur throughout the cold weather, and are

generally sufficient to extinguish a fire, until the end of February, unless the wind is very strong.

The hot west winds occasionally extend to the Eastern Duars, and materially affect the inflammability of the grass. The prevailing winds are, however, easterly, and in March, April and May there are strong winds and heavy storms called south-westerners.

The date at which the grass becomes sufficiently dry to burn readily, depends on the nature of the soil, and the date of termination of the monsoon, as well as on the amount and extension of the winter rainfall.

In the drier soils the grass in a sâl forest will generally burn freely by day, from the middle of February, but is quickly extinguished at night by the dew, and I have even seen a fierce fire in the Sidli reserve, in open grass land, extinguished in a few minutes by a slight shower on the 1st of March 1878.

The growth of fresh grass, and an occasional south-wester with heavy rain, soon renders the grass unflammable after the middle of April, and thus fires in May or June, which sometimes occur, do very little damage; only burning the upper portion of the grass and scorching the leaves of the trees.

Fires previous to the middle of February are also, as a rule, of little danger, and confine themselves to the grass land where there are more trees, or only a few scattered ones, and they do not penetrate into the mass of the sâl forest.

From the middle of February to the middle of April, fires are fatal to all improvement in the forest growth. The trees being dry and resinous, the flames mount to the topmost twig, and char and destroy the small branches, and sometimes trees of two feet and more in girth, which have been weakened in growth by repeated fires, are killed outright.

A sâl forest in blossom in March is a sight to be remembered; the flowers are deliciously scented; and the forest, generally so dark and gloomy, is covered with a fresh light green and pink foliage, and filled with innumerable parrots screaming and picking at the fruit, of which the seeds germinate on the trees.

I have seen a forest in this condition burned early in April, and besides the destruction of a whole year's crop of seedlings, the damage done to the trees themselves was irreparable.

The later in the season, before the commencement of the south-westers, that a forest is fired, the greater is the damage done to the sâl.

Every forester knows too well of how serious a nature this damage is, but as there are still unprofessional persons entrusted with forest management, and who are sceptical about the advantages of fire conservancy, I will explain what I mean for their benefit.

By the destruction of the leaves and bark, which are the breathing organs of trees, their vitality is impaired. As sâl is a deciduous tree, the burning of the old dying leaves is much less hurtful than the destruction of the young crop in March or April; but any interference with Nature is prejudicial.

Young sâl shoots, which spring up annually from an underground stock, are as regularly charred and destroyed by the fires, thus preventing the denser growth of the forest, and the consequent eradication of the baneful grass, which is the object of our treatment.

By jungle fires late in the season, saplings and young trees are frequently completely killed and left standing as black skeletons amongst the surrounding trees. The branches of larger trees and the top shoots of saplings being charred and destroyed; and they send out these side shoots along the stem which are called '*branches gourmandes*' by French foresters, and which rob the leading shoot of its proper supply of sap, and make the trunk knotty and crooked. But the sceptic will contend that sâl forests have been always burned, and yet have persisted to the present day, and still cover very large areas, yielding large supplies of timber.

It is incredible that before the settlement of Bengal under British rule the timber trade had developed to its maximum extent; whilst now the markets of the Goalpara district alone, send 300,000 logs yearly to Bengal for house posts and for boat building. The trade has, however, been steadily carried on for the last 100 years, and is now only flagging on

account of the lack of superior material; as sâl trees exceeding six feet in girth are only to be found in a few remote corners of the Garo Hills.

To show what the demand is, during the present year, sâl logs of 7 feet in length and an average girth of about 6 feet, were sold at Rs. 27 a pair, although the market was badly attended by purchasers, and a local landowner, who is building a large mansion, was obliged to purchase timber for planking at this rate.

Where formerly each woodman paid Rs. 4-4 per axe to the Bhuteas for permission to fell as many sâl trees as he could in a season; standing sâl trees not exceeding 5 feet in girth are now being sold by Government at the rate of Rs. 10 per tree close to the Bhutan frontier; and over 1,500 trees have thus been sold during the present season. Besides the enormous extraction of material from the forests, cotton jhumming has done its work, and is still destroying sâl forests in the Garo Hills.

Previous to this great development of the timber trade and of cotton jhumming, resulting from the security of life and property under British rule; we can suppose—for I doubt whether previous records or statistics are available; that the sâl forests, now thinly stocked and full of grass, were of the nature of the virgin sâl forest in the Garo Hills already described.

In his book on the Timber Trees of India, Dr. Balfour states:—"The sâl tree grows remarkably straight or tall in the forest. Its seed has the utmost susceptibility of germination, with a vitality so limited in duration that it will not survive many days unplanted. It ripens at the commencement of the rains, and after the first shower falls actually sprouting from the trees. In consequence young plants come up in the utmost profusion, forming patches of forest, which are literally impenetrable till thinned by the woodman."

It is only owing to these excessive powers of reproduction that sâl forest in inaccessible places has persisted at all to the present day, in spite of the jungle fires, which threaten its existence; and which even now, if left to themselves, would

make the vast sâl forests of India of which Dr. Balfour speaks, a memory of the past.

One of the great difficulties in forest conservancy in Assam consists in the scarcity of labor, owing to the scanty population, and their great prosperity and wealth; and also in some cases to their want of energy, compared to the Hindustanis and Bengalis.

The *Mechis of the Eastern Duars* are powerful and laborious, but find a ready field for their labor in cultivating the vast tracts of waste land; seldom staying more than a few years in the same place, except in the east of the district, where the population is denser and more settled.

They irrigate their rice fields at the cost of a great deal of labor, cutting canals sometimes of a section of 180 square feet; and bringing the water for several miles from the upper levels of the streamlets.

Hundreds of them are also engaged as timber cutters, and work out several hundred thousand logs annually from the private and Government forests of the Goalpara and Garo Hills districts, and from Bhutan. Great numbers are also tempted to the Assam tea-gardens by the high rates of wages offered, and after two years' absence return to their homes with savings amounting to Rs. 100 or 150 with which they start housekeeping and farming.

During the present season I have offered as much as Rs. 9 a month for *Mechis*, but have only recruited twenty or thirty men at this rate.

The only other labor available is that of *Nepalis* from the hills or plains.

The former get fever and dysentery, and are of very little use for the hard forest work, and probably the stronger men find labor nearer their homes.

Several hundreds of them come every year to the district to cut rubber in Bhutan, at which they make a good deal of money. *Nepali* plainsmen are excellent for forest work, and strong and stand the climate, and I have got a small force of twenty men from this source during the present season at Rs. 8 a month.

They come as woodcutters to the large zemindary forests,

extracting the timber in bullock carts, and not, as the *Mechis* do, by manual labor alone.

Up to the present time fire conservancy in the Eastern Duars has been only attempted in the Sidli and Guma reserves—both *sâl* forests with strips of Evergreen forest along the watercourses and including large tracts of grass land.

The Sidli reserve contains 50 square miles, and the Guma reserve about half that area.

Fire conservancy was first attempted in the Sidli reserve in 1877, and in the Guma reserve in 1878.

Large areas in the former forest were saved from fire in 1877 and 1878, but in 1879, although the forest had been completely isolated by burning all external grass, a fire arose in the interior in March, and almost burned the whole of the reserve. The Guma reserve was burned, both in 1878 and 1879, in spite of the measures taken for its protection.

The forests were then simply isolated, and where this could be done early enough in the season, the grass on either side of pathways was cut and burned. But the scarcity of labor prevented us from cutting internal fire lines.

Under this system the protected forest tracts, though inaccessible to fires from the exterior, contained a mass of combustible grass which could be fired almost without fear of detection in the months of March and April.

A good deal of dependence was placed in the Sidli reserve, on the strips of Evergreen forest which divide it longitudinally.

But in the excessively dry season last year, these were found of no avail, and the entire forest was burned, masses of blazing grass being blown completely over these Evergreen forests, where they were thinnest, for they can nowhere support a fire within themselves in the driest season.

These two forests have been divided into square miles by lines 20 and 10 feet in breadth, cut straight from north to south, and from east to west.

The north and south lines in the Sidli reserve run parallel to the *jhoras*; and several of them cross no *jhoras* at all, or only insignificant ones, and are, therefore, good lines of communication from the boundaries to the interior of the forests.

The east and west lines being at right angles to the jhoras, are available for conveying timber to these, which are always used by timber-cutters for floating their logs to the markets. A good road will also shortly be constructed through the middle of the forest.

In the Guma forest the compartment lines are also found to be very convenient for the removal of timber, some of them being already used by bullock carts, and they can be supplemented, where necessary, by diagonal lines converging to the principal dépôt.

From the elongated nature of the Sidli reserve no other means of communication will probably be required besides the compartment lines; except a road through some of the cultivated land surrounded by the reserve.

Rough prismatic compass and chain surveys have been made of these reserves, and maps drawn on a scale of 4 inches to the mile in which all boundary mounds, village pathways, and patches of cultivation are shewn.

The jhoras were not surveyed, but traced in from the revenue survey map, their position being corrected where necessary. All patches and tracks of grass land, or Evergreen forest, called locally Lower Hill forest, are sketched in very approximately, and their extent and that of the sâl forest shown on the map by different colored tints. The map of the Sidli reserve has been photozincographed by the Survey Department on a reduced scale of one inch to the mile. This map is also tinted, and the cost of the survey was very trifling. Until these maps were available, we were working completely in the dark, and there was no check to the expenditure, or progress made by subordinates. The Forest Ranger in charge of Sidli reserve submits monthly tracings of the map, showing the progress of fire lines and the amount of jungle burned; and a tracing is sent annually to the Direction Office, on which all forest preserved from fire in the dry season is shaded in.

The Forest Survey Department is not rapid in its movements, and if all survey work were delayed till they visited Assam, forest conservancy would be comparatively, I might almost say, at a

standstill. At the time of the survey, trees on one-twentieth of the area of the forest were counted in the Sidli reserve; and in the Guma reserve the forest growth was estimated roughly in a similar proportion to the area of the forest.

The great labor in fire conservancy consists in cutting fire lines, twenty feet of grass being cut on either side, and then the jungle heaped in the centre and burned. In this method there is always danger of the fire getting beyond control of the men, and on this subject Mr. Baden-Powell once wrote a short article for the *FORESTER*, on what he called the ladder system of fire line, to show how to avoid this danger; but in a country where labor is very scarce, cutting fire lines is very costly, and it is difficult to get the work over early enough in the season. I estimate that with Mechis, who work most expeditiously, it costs Rs. 25 a mile to cut a fire trace 20 feet broad at four annas a man.

A great number of men must also be retained in burning the jungle, so as to extinguish the fire if it gets into the adjacent sal forest.

The whole method involves great anxiety and risk, unless undertaken early in the season, and must be supervised by an experienced and trustworthy officer.

I will here describe the system I have adopted in the Sidli forest for the present year, from which, with some modifications resulting from experience, I have the greatest hopes.

I have sub-divided the forest into four blocks, which are shewn on the map, and each contains about 12 square miles.

A head forest guard, on Rs. 10 a month, who can read and write Bengali or Nagri and keep accounts, is in charge of each block, with two ordinary forest guards to assist him on Rs. 7 a month.

The whole is under the control of a Forest Ranger on Rs. 50 a month, who resides in the forest, and constantly inspects the progress of the work.

The labor difficulty has been partially avoided by concession of dead house posts and firewood to such villagers as are willing to assist in the work, whilst all others are entirely excluded from the forest, except along authorized pathways.

But the main points held on view during the present year have been, to take advantage of the fact that grass growing outside a sâl forest will burn much sooner than that under the trees ; and that grass beaten down and dried by the sun will burn much sooner than grass left standing :—that grass burned shortly before nightfall before the end of February, will go out of itself, unless there be a wind blowing, as soon as the sun sets :—and that fires can readily be extinguished by a few men, when lighted from a line from the direction in which the wind is blowing ; provided there be no danger to the forest in front of the wind ; and owing to Evergreen forest, or to a fire line having been already prepared the fire will go out of itself in the direction in which the wind takes it.

I fired myself on the 19th of December, a line where the grass had been beaten down to a breadth of 300 feet. The fire was entirely confined to the beaten down grass, and left the grass on either side standing like a wall ; though no grass had been cut along the sides of the fire line. The lower leaves on the sâl trees were scorched, but the leading shoot even in seedlings a few inches in girth was uninjured. Smaller seedlings were of course destroyed, but not where they were very numerous and protected one another.

The fire burned with a great deal of crackling and smoke, but gave out very little heat.

I examined the same place a month later, and found the trees almost as green as if fire had not been applied.

I fired then a portion of the line which had not been burned, and owing to the wind the fire penetrated into the forest for a distance of a few hundred yards where the sâl was scattered, but went out of itself as soon as it reached the denser forest.

In the Sidli reserve I fired large tracts of reed jungle on the 28th of February. This might have been fired somewhat earlier, but attempts had been made to burn it in the early part of the month, and had failed as the jungle was not then sufficiently dry to burn readily.

These tracts of reed jungle communicated directly, and without any fire line being cut, with portions of the sâl forest, but as this was in the direction from which the wind was blowing,

we had no difficulty in extinguishing the fire with a few coolies, and all fire went out soon after nightfall.

From these remarks it will be seen that a great deal of experience and knowledge of the position of jhoras and damper parts of his forest will enable an officer to dispense with many fire lines, which is a very important help to fire conservancy, where labor is scarce, besides being a matter of economy.

The fact that beaten down jungle will burn readily long before standing jungle is also of very great importance; as fire lines can thus be prepared with one-sixth of the labor and expenditure compared with fire lines where traces are cut, and the grass heaped between them and burned.

Besides the concessions referred to above, to the Mechi villagers bordering on the Sidli reserve; I have encouraged them to burn all grass near their crops and villages, whether within or outside the reserve up to a date to be fixed by the Forest Ranger.

This will prevent their villages being burned, as one was last year, and also furnish grazing land for their cattle. None of these permits give any vested right to forest produce, however, as they are limited to a year, and are revocable at will by the Divisional Forest Officer.

The villagers are also encouraged to cultivate all grass lands up to the sâl, whether along the boundaries or in the interior of the forest. Permits to cultivate in the reserve will give no proprietary right to the land, and are also only binding for one year.

I have seen sâl seedlings spring up densely near sâl trees in patches thus cultivated; and abandoned after two or three years, as is the custom of the Mechis, who prefer virgin soil for their rice crops.

A large extension of this system is expected next year, by permits to cultivate cotton in the grass lands, and fire lines in the reserve. At present Mechis go long distances to purchase cotton at Rs. 5 a man's load from the Garos and Bhuteas, as their clothes are nearly all woven at home by the Mechi women, English cotton goods not being heavy or lasting enough; for their taste. Having thus enlisted the good services of the villagers, we have beaten down the grass from the early

part of November in all compartment lines, and round all boundaries.

We have also beaten it down to a breadth of 100 feet, on each side of all pathways, and to a breadth of 150 feet on each side of a compartment line dividing the reserve in the centre from east to west.

The cost of beating down grass at 4 annas per man is about Rs. 4 a mile for a breadth of 24 feet, and the Forest Ranger hopes to reduce this another year to Rs. 2-8.

It is hoped that this work will be done by contract as soon as the people have become used to it. It is not necessary to beat down the whole of the broad fire lines; 24 feet, beaten down on each side, can be first dried in the sun and burned; and the standing grass between the lines burned subsequently, and thus a great saving of expense results.

The grass beaten down burns much earlier than the standing grass, and standing grass without sâl burns earlier than grass under sâl forest.

As stated before, grass beaten down, and fired early in the season burns slowly and with little heat, and the saplings are uninjured by the flames beyond the scorching of their leaves, and many of the seedlings escape. The grass beaten down in the compartment lines burns in December, leaving the grass standing on either side like a wall.

It was found sufficient to employ a Forest Guard and four coolies to burn the beaten down grass on the broader lines, and with only two coolies in the compartment lines 20 feet broad. All tracts of grass land, without sâl, are burned as early as possible, and the fire then goes out of itself when it reaches the Sâl forest.

As soon as all firing has been completed, and several of the fire lines require two burnings to get rid of the beaten down grass in them, the men will be employed in hoeing up a bridle path, 3 feet wide in the compartment lines, and along the boundaries. Smaller stumps will be extracted, and logs removed from across the lines. Ghats will be cut down to the jhoras which are very shallow for the most part, and bundles

of reeds put over swampy places. Thorough and rapid means of communication will thus be furnished to the interior of the forest, and contrary fires can readily be lighted in case of a fire breaking out.

The villagers, who have received permits for produce, are bound to assist in extinguishing a fire, and the heads of all surrounding villages have promised me their assistance in this respect.

I offer the above results of our experience in Assam for the criticism of your readers, and trust that the subject may be fully discussed, so that the best method of fire conservancy may be determined in all its bearings.

W. R. FISHER.

Ceratonia siliqua—The Carob Tree.

Translated from the Italian by J. F. DUTHIE, F.L.S.

BOTANISTS call this plant *Ceratonia siliqua*, L. It is also called *Siliqua arbor*, Cæsalp. The Italian names are Bacelli, Caroba, Carruba, Carrubis, Carrubs, etc. In the East it is known as Kharrub, and the seeds Kharabos; by the Germans Bochshörnlein, the pods Johannisbrod; by the English it is known as the Carob tree, and the fruit St. John's bread or Locust bean.

The Carob belongs to the family of the *Leguminosæ*, and to the class Polygamia of Linnæus; that is, on the same plant there are monœcious and dioecious flowers, but not unfrequently individual trees are found which bear only male flowers, and hence they are sterile; also there are some which bear only female flowers, and these are fertile. This tree is much branched, increasing more in breadth than height. It is evergreen, but the leaves are shining and entire. The flowers are small; the fruit is a pod 1 to 2 decimetres (14-8 in.) in length, and between 2 and 3 centimetres (about 1 inch) broad; it abounds in saccharine pulp.

The Carob has few varieties:—(1) *Carrubo Franco* with short thin curved acuminate fruit. It is common in Spain and

Portugal and ripens early. (2) *Carrubo masculino* (*Ceratonia vulgaris*). The fruit of this is good for animals; it is the commonest kind. (3, *Carrubo femmenello* or *Zuccherino* (*Ceratonia siliqua latissima*, Risso,) bears a small quantity of fruit, but they are larger and long, pulpy and sweet, and are consequently eaten in preference by men.

The wild Carob is sterile; there is a preponderance of male individuals; they can be utilized, however, for grafting on.

The seedling Carob, in favorable conditions, becomes a fine tree with large and symmetrical head. It is not a tall tree, but its branches are arranged with regularity. With a little care the plants acquire a handsome appearance. The soil becomes filled with an intricate network of roots, which often renders the cultivation of other plants difficult. The Carob is generally reproduced by seed, as it is very difficult to make cuttings succeed. Before the seeds are sown, they are treated as follows:—In the spring the seeds are picked out of the pods, and immediately put into water, where they remain for three or four days, care being taken to renew every day the water in which they are soaking. When the seeds have swelled they are sown in the soil, that is to say, in the place where it is wished to have the plant, but more often in a piece of ground which has been well worked and manured, called a nursery. In the latter case, the piece of ground which has been prepared to receive the seeds is watered; it is then left to dry as long as to allow without difficulty holes to be dug at a distance of a little over one and half feet apart, into which are placed the seeds five in each hole. The seeds are lightly sprinkled with earth, and the nursery is made. If the temperature of the air remains favorable, after eight or ten days the seedlings will show themselves. Being satisfied that the seeds have all germinated, and as soon as it is considered convenient, the seedlings are transplanted, taking care to leave in each hole the strongest looking and best rooted plant. By sowing the seeds in groups of four or five, one has the advantage of selecting and tending the best seedlings, and you are sure not to see in the nursery empty spaces in con-

sequence of failures, as would happen if the seeds were put in singly in each hole. It is necessary to thin out the seedlings in the nursery, otherwise they would suffer by growing up in bunches of three, four and five. The seed of the Carob gives rise to a plant which may be dicecious, that is, having both male and female organs in the same flower, as is ordinarily the case, or the plant may turn out to be monœcious. To ensure the fruitfulness of all the plants it is necessary to graft them, and this is done when they are still in the nursery and have reached the height of about 0·60m. (about 2 feet.) The scions must be those from a fruit-bearing tree. Having finished the grafting of the plants in the nursery, they remain until their stems obtain a diameter of about three-eighth of an inch before transplanting them into the plantation. It is necessary to undertake transplanting from the nursery to the plantation, when the plants are still young, it being indispensable to the success of the plants that they should be moved with a large ball of earth and with as large a quantity of roots as possible. As the plants become older, they are less manageable, and the operation becomes more difficult. Transplanting is one of those operations which requires to be undertaken with the greatest care; on it depends the future welfare of the plants.

In order to facilitate transplanting, it is advisable to water the ground thoroughly; it is in this way only that it is possible to ensure having with the plant a ball of earth eight to twelve inches in diameter. The plants should be put into the plantation at a distance of three to three-half feet. The treatment next required for the plants is to render the soil fine, clean, and friable, and in places where the severity of winter is likely to injure the plants, they must be protected if they are still small, and if large, the stems should be covered with straw, and the lower branches cut away. At the age of four or five years the plants are transplanted from the plantation to their permanent place, and are put in at the same depth as they were in the plantation. In carrying out this second transplanting the same care must be exercised as in the first. It may be undertaken during the summer, but then it is advisable to water the plants thoroughly; if

in the autumn, it can be done with less watering. Carob plants require to be placed at a distance of 15 metres, about 50 feet apart, since the roots occupy as much space as the branches.

From the earliest age of the plant, endeavours should be made by means of pruning to form it into a head composed of four branches. This done, it will be sufficient to remove suckers, and to make a few slight clippings, this tree being one which is much crowded with branches. As the tree becomes advanced in age the upper branches die off; at this time vigorous pruning up to the healthy part will restore the plant to good condition. The dead trees must not be replaced before the ground is cleared of the roots of the dead plant.

In the neighbourhood of Naples, and especially on the spurs of Mount Vesuvius, the Carob is abundantly cultivated and with much profit. But the system of cultivation in these parts differs considerably, if not entirely, from what has been described above, and seems to be preferable from its simplicity and the saving of time. The cultivators of the Vesuvian campagna are not in favour of nurseries and plantations. They maintain that transplanting kills the young plants. Considering the nature of their climate and soil they are perhaps right, and the more so, since they have found the system they have hitherto followed to be the best.

In February they sow the seed in little earthenware pots, one seed in each. As soon as germination has commenced, they bury the pot in the spot where they wish the plant to grow and remain permanently. During the summer they water them, but they cannot always provide sufficient water, in which case they cover the young plants with leaves or branches. The root, as it grows, breaks the pot, and the plant may be considered secure.

They say that seedlings from seed of the cultivated plants need not be grafted, but if required, they wait until the plant is four or five years old, and bud or graft on it towards the end of May.

This plan is to be recommended, both on account of the very

small cost incurred in raising the plants, and in the certainty of their success; but it cannot be said to tend to hasten the fruiting of such plants. Plants raised on this system remain for nine or ten years before they first give fruit, whereas those which have passed through the nursery and plantation are in fruit after two or three years.

It is not an uncommon circumstance to see seedlings under the trees which have given fruit; it evidently proves that the seeds have fallen naturally on to the soil. If proper attention in the way of watering and transplanting be given to these seedlings, trees may be obtained which will differ in no respect from those raised according to the other method.

In order to derive profit from self-sown Carob trees which are somewhat aged, or which have given no fruit, or it may be only a small quantity, and of inferior quality, it is recommended to graft on to them. If it is a male tree that is to be operated upon, a large number of its branches should be grafted with female shoots; if, however, the tree is a female, it will be sufficient to graft only a small number of its branches with male shoots. In any case it is only the young healthy branches that should be grafted upon. Should the grafting on the adult plant succeed, it will give fruit after four or five years.

The Carob flowers in July and August, and the fruit does not ripen until the succeeding autumn. The flowers are generally borne on the older branches, and sometimes they appear even on the main trunk.

The fruit, which is at first green, changes afterwards to a reddish brown colour. The appearance of this colour, together with the spontaneous falling of some of the pods, is a sign that the proper time has arrived for gathering the fruit; this occurs generally in the month of September. The operation is a very simple one—the pods are collected by hand, or, when this is not possible, they are beaten down with a pole. When gathered, the pods are spread out on the floors of dry and well-ventilated rooms, or laid in alternate layers with straw. They must not be collected into heaps, otherwise

they will ferment and turn black. They must quickly be made use of, or they will fall to pieces, become white and worm-eaten.

Climate.—The cultivation of the Carob has a northern limit, beyond which its existence is rendered critical by the cold of winter. It may be said with tolerable accuracy that the Carob occupies the region of the orange, that is to say, when the orange can grow without artificial protection during the winter. It has been stated that the Carob grows in the same climate as that of the olive, enjoying, therefore, a climate more northern than that of oranges and such fruits. We believe that this opinion is not accurate. Thus, for a great distance along the Abruzzi coast, the olive and the orange are cultivated with much profit, and the Carob also thrives well. At a few thousand feet above the sea, however, it is found, in spite of numerous trials, that the orange and Carob cannot exist; whilst the olive can be cultivated with advantage even to the foot of the Majilla. Lastly, in Lazio, in Umbria, in Tuscany, and in some parts of Northern Italy, where the olive grows, neither the Carob nor oranges are cultivated. In Italy it can only be profitably cultivated in the true orange zone, preferring the lower parts of sunny slopes.

Soil.—The requirements of the Carob regarding climate are amply made up for by the ease with which it adapts itself to all kinds of soils provided they are dry. It thrives well on stony ground and on limestone rocks, as for instance near Gaeta and Amalfi, also on the clay soil along the Jonio Coast, as well as on the volcanic lava of Mount Vesuvius and Etna. Large Carobs may be seen on cliffs and rocks with scarcely a handful of soil to nourish them. Marshy and damp soils are the only ones where the Carob will not prosper. It will of course grow better in rich, deep, and friable soils, and attains to an immense size, occupying often an area of several hundred square feet. It is marvellous the rapidity with which the plant grows in good soil, and where the climate is favorable. In one year the young plant may measure several centimetres in girth, and two or three

metres* in height. The Carob plant resists admirably the dryness of prolonged droughts, and whilst the olive droops and other plants die during the excessive heat, the Carob seems to be unaffected; notwithstanding this, it is benefited by irrigation, but this operation should be conducted with great judgment, and special care should be taken to allow the water quickly to drain away, and not remain near the plant.

Manure.—It is needless to say that the Carob, like all other plants, is benefited by manure, though the cultivators in the neighbourhood of Mount Vesuvius maintain that it is of no use; nay, on the contrary, that it does them harm, "it will burn them up," as they say.

They compare the Carob with the prickly pear, a plant which, although so distinct, yet resembles it as regards its requirements in the matter of climate and soil. Now according to these cultivators, if the plants are placed under the same conditions, the latter, that is the Prickly Pear, require manure and prefers liquid manure; the Carob on the contrary suffers by its application. They have found it, however, of some use to dig a trench during the summer all round the trunk of the Carob in which they bury some fresh grass. We cannot say how much weight should be given to the assertions of these people. Surely the small quantity of grass which they bury is too insignificant to serve as manure for the Carob; perhaps the fact of removing a small quantity of earth, and the moisture communicated by the grass, may be of some slight benefit to the plant. A very rational explanation of this result—and perhaps the only true one—may be found in the extreme fertility of the soil which is volcanic. Considering these special conditions and many others which are favorable to the plant, we could not generally recommend to cultivators of the Carob the practice hitherto adopted by the cultivators in Mount Vesuvius.

In Puglia and such places, where the cultivation of the Carob is more frequent, manure is given to the plant with great

* A metre equals about 3½ feet.

advantage. The manure commonly used is a mixture of dung and green plants; seaweeds cast by the waves are preferred in districts near the coast.

Association.—In regard to the association of the Carob and other plants, it is convenient to make a distinction between a plantation in which the trees are massed indiscriminately, as may be seen on the spurs of Vesuvius, where the climate is comparatively cold, and where the climate is hot. In the former case, the thick shade of the trees impedes the well-being of any other cultivated plants unless the cultivators are willing to suffer loss by reducing the number of Carob trees. In the case of the latter plan, when the plants are arranged in regular lines, and in a hot climate, their shade is useful for keeping the soil cool. You can then grow rye, wheat, rice and other cultivated plants alongside the Carob. In the district of Torre-del-Greco, we happened to see under the Carob trees sufficient grass to be cut with a scythe, or that could be ploughed in as manure, and lupine was growing to a marvellous size. There would be room for vines also between the rows of the Carob were the latter arranged with any sort of order.

Diseases.—It may be said that as yet the Carob has not been affected by any disease. In common with most cultivated plants, however, it is attacked occasionally by Aphides called "pidocchi," but the limited number of these insects, and the ease with which they are destroyed, renders the disease, if such it can be called, of little or no importance.

The remedies against such animals are very simple and easy to apply. Should they have obtained a footing on the small branches of the plant, it is better to cut off these branches and burn them. If, however, they have encroached more extensively, it is necessary to destroy the animals by brushing the leaves one by one. In the latter case, it is also found useful to throw sand over the plant from top to bottom several times. The fruit of the Carob is attacked by a kind of butterfly, "tignuola," which, in the larva state, penetrates the fruit and destroys it; sometimes the damage done by this insect is serious. Entire heaps of Carob beans are found to be so worm-

eaten and full of maggots, that horses and other domesticated animals refuse to eat them.

To guard also against these insects, the remedies are simple and certain. They will hardly show themselves in the store house, but before they have time to lay their eggs some means must be sought for their destruction. The fumes of sulphur anhydride, resulting from the combustion of sulphur, are known to be suitable for the purpose. If this chemical operation is assisted by mechanical means, and the corners and walls of the store rooms are kept perfectly clean, the fruit may be kept free from harm for another year.

Produce.—The Carob begins to give fruit more or less early according to the treatment it has undergone in the early stages of growth, but never later than the tenth year. The produce increases year by year, as the tree grows, up to a period of about 30 years. One must take care to make due allowances as in the case of many other kinds of fruit trees, "*uno pieno et uno vuoto*," as the saying is. It is certain that an adult tree in healthy condition and in favorable years will give as much as 10 quintals* of fruit; in average years one may calculate upon 4 or 5 quintals. The price of the fruit in ordinary years is from 6*s.* 8*d.* to 8*s.* per quintal; this year they have been sold for as much as 12*s.*

Profit.—The produce of the Carob is considerable; the plants grow, however, under conditions so diverse that the out-turn can only be given approximately. It is difficult to give any estimate regarding its cultivation in Italy, as it is not anywhere carried out systematically and on a large scale.

Fleury, the French Consul at Valenza, has made a computation, but it rests on data which are very vague, and not much to be depended upon.

He supposes a field covered with Carob trees worth 2,500 lire and calculates the produce of each year as follows:—

6,300 kil. of fruit at the average price of 6 lire per quintal	=	378	Lire.
Cost of cultivation	=	78	
„ collecting	=	50	
Nett income...	=	250	

* A quintal is equal to two hundredweights nearly.

The ground valued at 2,500 lire would give then 10 per cent. profit. The lira is equivalent to the franc=10*d.* As we have said, the data on which the calculation is based are vague, indeed nothing is known as to the age and the number of the plants, the area of the ground, or regarding the quality or quantity produced by plants of various ages.

De Candolle alludes to a calculation made by the cultivators in the neighbourhood of Nice and Monaco. They estimate the crop of the average tree to be 100 kilogrammes of fruit, and that 4 trees on a hectare (=nearly 2½ acres) will give 4,400 kil., that is, at the rate of 10 per cent per kilogrammes, they will bring in 440 lire. Others say, perhaps with a little exaggeration, that a large and well-cultivated tree can produce fruit to the value of 150 lire, and that a hectare of ground covered with trees ought to yield as much as 5,000 lire every two years. This much we can guarantee without fear of being found to have outstepped the truth. In the territory of Torre-del-Greco, during the present year, a Carob tree has given nine quintals of fruit, which were sold on the spot for 15 lire per quintal.

To cultivate the Carob, so that its yield of fruit in relation to cost may become a source of profit, steps should be taken to utilize rocky and comparatively sterile ground.

In Sicily the cultivation of Carob is left to nature, whereas formerly it was not so neglected, and its fruit used to constitute an important item in the food of the inhabitants. But it appears that the introduction of the Prickly Pear and the great use made of its fruit, as well as the ease and rapidity with which it grows, have caused the Carob to be neglected. Notwithstanding this, enormous quantities are exported from Sicily. In Sardinia and Corsica and at several places on our coast, the Carob would be a great acquisition.

It is with great pleasure that we watch the interest taken by the inhabitants of the Amalfi Coast in advancing the cultivation of this hitherto neglected plant. When visiting this neighbourhood we had the opportunity of observing large plots of ground ploughed and intended exclusively for Carob cultivation. The cultivators say that from the day on which they substituted the Carob plantation for the olive grove, their pros-

perity commenced. They have in fact become doubtful whether the cultivation of lemon is more profitable than that of the Carob.

Uses.—The countries in which the Carob is found, and where it is more or less cultivated, are the coast of Portugal and Spain, the Balearic Islands, the Southern Coast of France, the whole of Western Italy, and eastwards, beginning from Elba, Corsica, Sardinia and Sicily, to the Islands of Sissa and Sesina off Dalmatia, Zante, Corfu, and Cephalonia, Greece, and the Islands of the Archipelago; also the Byzantine country, Asia Minor, North Africa, where it would appear that Morocco marks its southern limit, whilst Genoa is the limit of its north extension. In Cyprus it grows at an elevation of 2,000 feet. I have not been able to ascertain whether it has also been found in the Island of Madeira, the Canaries, or the Cape-de-Verde Islands. At Valenza, the Chocolate-makers introduce the flour of the Carob into a cheap kind of Chocolate.

The druggists prepare decoctions which are frequently used in case of cold in the chest, and generally in combination with dried figs. It is employed also as a mild laxative like the tamarind. The juice of Calabrian Liquorice contains the pulp of Carobs. The Arabs use it instead of sugar in the preparation of confectionery, and from it they extract by means of fermentation and distillation a kind of spirit.

The Carob is used as an article of food for men, but especially for domesticated animals. In Barbary, the pulp of its fruit is mixed with barley and wheat flower, and made into bread, but the Carob is much more important as a food for animal, especially in hot dry climates, like those situated on the southern coast of the Mediterranean, where ordinary forage plants are deficient. Carob pods are eagerly devoured by pigs, whilst horses, mules, donkeys, cows and sheep voluntarily eat them.

In places where straw has to be given as food during the winter, it would be very advantageous to add some pounded Carob pods.

Ottavi, in his "*Agricoltura Meridionale*," says that a hectare of Carob trees would give a much larger return, and a more certain one than that of the better kinds of forage; being a

tree it can resist better than a herb the scorching heat of summer.

The bark of the Carob is employed medicinally. An extract is made of it, which is administered in cases of diarrhoea. The wood is very good for building purposes, and also takes a good polish. Carobs are an important constituent in the manufacture of artificial essence of Pineapple, which is much used in confectionery. This essence is indeed manufactured chiefly from butyrate of ethyl, which is obtained by the combination of alcohol and butyric acid, and the latter is found in a free state in Carob beans. The following methods for obtaining butyrate of ethyl from the fruit of *Ceratonia* may be briefly indicated. There are two methods—the one in which the butyric acid only is extracted, the other by which not only is the existing butyric acid utilized, but a portion of the sugar is converted into butyric acid.

Stinde says that Carob beans, which can be obtained at a moderate price, contain the acid already formed in such quantity, that by pulverising them, seeds and all, and dissolving them in water made slightly acid with sulphuric acid, the liquid resulting from distillation will contain from two to three per cent. of hydrated butyric acid.

Reinsch, observing that the Carob contains a large quantity of sugar accompanied with a peculiar ferment capable of inducing the butyric fermentation of the saccharine substance, if prolonged for a sufficiently long period, has discovered a method of preparing butyric acid in large quantities than by Stinde's method.

Fifty kilogrammes of Carob are reduced to powder and thrown into a vat standing in a warm place, such as in the vicinity of a boiler or a baker's oven. Water at the temperature of 20° Centigrade is poured over them sufficient to form a smooth paste. After four or five days twelve kil. of powdered marble or chalk are added; it is then left to ferment.

As the substance becomes denser, it is necessary to stir it, adding, when required, more warm water in order to prevent its thickening too much. After a week's time, if done during the summer, the fermentation is complete; during this time the sugar of the Carob has been converted into butyric acid and butyrate of lime by the action of the acid in the carbonate of

lime. The substance containing the butyrate of lime is transferred from the vat in which the fermentation took place into a large copper vessel furnished with double walls, between which steam should be allowed to circulate. On the evening preceding the day on which the distillation is to take place, a mixture of 18 kil. of the sulphuric acid of commerce, and 60 kil. of alcohol at 95° is prepared, and on the following morning it is thrown over the paste in the copper vessel, stirring it all the time with a stick, until the acid and the alcohol are thoroughly mixed with the paste. At this stage the vessel must be covered and hermetically sealed, and steam is allowed to enter between the two walls of the vessel; the distillation will commence immediately, and as soon as the distilled liquid begins to fall in a continuous stream the quantity of steam should be diminished.

The first 500 grains of the distilled liquid should be collected separately, and the operation continued until the product falls only in drops. The portion of butyric acid not drawn off by this process is left to digest with a solution of chloride of lime. The stratum of ether is drawn off by means of a funnel and stop-cock, or by any other convenient way, and is rectified over magnesia, in small quantities inside a glass retort. Stinde remarks that in the case of butyric fermentation, when old cheese or meat is used as a ferment, the Carob is to be preferred to the sugar of fecula, to sugarcane and to starch, because in the case of these latter the fermentation process demands too much time, and variations of temperature occur which give rise to secondary products.

Stinde also expresses a doubt whether from the butyric acid, produced by any other method, an ether can be obtained, which possesses that delicacy and fragrance required by manufacturers of confectionery.

In every case when Carob beans are employed for the operation above described, it is important to see that the pods are free from mould and not worm-eaten; for were this the case, the butyric ether will have a disagreeable smell and taste.*

In the province of Naples the Carob forms a large proportion of the food of hired horses and beasts of burden generally.

* These notes on the extraction of butyric ether from Carobs are taken from the *Encyclopædia Chimica Italiana*, of Signor Selmi, and the other portion of the paper from *Agricoltura Meridionale*, by Doctor T. Simonette, republished in *Bullettino*

TRANSLATOR'S NOTES.

The information contained in the foregoing account of Carob cultivation in Italy is worthy of considerable attention by those who are undertaking to extend its cultivation in this country. The results of experiments already made show clearly enough that the climate of certain parts of Northern India is favorable to its growth as a tree, and steps should now be taken to increase the yield of the fruit as well as to improve its quality. I have not heard that any attempt has been made in India to propagate the plant by grafting. This operation, which is considered by the best cultivators in Italy to be essential to the production of good fruit, could easily be carried out under careful superintendence, and the grafts, when ready, distributed in the ordinary way. It would hardly be possible, nor indeed would it be necessary, to have every plant grafted, for seedlings, unless of the male sex, are capable of yielding a large amount of fruit of very fair quality, especially if the seeds are obtained from good fruiting varieties. These seedling trees might also be utilized as shade trees for roadsides or formed into *baghs*. The Carob is an evergreen, and if properly cared for, will grow into a large handsome tree. The climate of North-West India, as far as temperature is concerned, would appear to be all that is needed for the welfare of this tree. It remains, however, to be observed to what extent the swampy condition of the ground during the rainy season is likely to affect it. In any case endeavour should be made to plant the trees, wherever it is possible, on rocky ground, or where the soil is well drained. Such conditions exist over large tracts of country both in the North-West Provinces as well as in the Punjab along the lower slopes of the Himalayas. Supplies of seed and grafts are shortly expected to arrive at Saharanpur; these, with the trees which already exist in the Botanical Garden, will form sufficient material for commencing operations in accordance with the methods recommended in the foregoing paper. The author of this article has, I understand, recently published as a sequel some observations regarding the application of Carob as food for horses.

J. F. D.

Deodar Sowings in the Punjab Hills.

TO THE EDITOR, "INDIAN FORESTER."

SIR,—Attempts in the past to rear Deodar in the forest by artificial sowings seem generally to have been successful in the Punjab. It may be said that, provided fellings are carried out according to certain recognised principles, the regeneration of a forest may safely be left to natural reproduction, and that the chances are but little artificial aid will be required. But many a Forest Officer may reasonably enquire, "What are the principles which should guide us in felling operations?" Natural intelligence, an enquiring mind, and a love of forestry, grafted on practical working knowledge, will, it is true, go a long way towards ensuring success; but I take it, these attributes would be far more useful to their possessor, and of greater financial worth to Government, if a little more were done in the way of printed "suggestions" (by authority) as to certain methods of treatment under the varying circumstances of soil, aspect, slope of ground, undergrowth, &c.

It is true that a careful perusal of Dr. Brandis' Inspection Reports supplies a vast amount of useful information, and it should be the aim of every forest officer to note down and carefully work out the suggestions contained therein, but do we do this? When the post brings in a pile of Administrative Reports, Reports of the Inspector-General of Forests, Circulars, and the Forest Department List—the last is, I fear, the first taken up—one gives a glance down its pages to see how one stands in the order of seniority, and probably the result is a heavy groan at the slow promotion, or perchance an expletive bursts out when one finds that yet another had jumped over one's head. That officer is for the time being in no mood to study with advantage the interesting report of the Inspector-General, so it is laid aside till a more convenient season. I have done this myself, but that was before competition stepped in, and I have smartened up since.

My object in addressing you was, however, to jot down some of my own experience, in the attempt to rear Deodar in the forest from seed.

One experiment on a small scale was made in a forest block which had been cleared of *all* its Deodar crop; there was a fair sprinkling of the "Spruce" and "Silver Fir," with a dense undergrowth of "Indigofera," "Colurna," and other shrubs; the ground had a northern aspect; the Deodar likes shade, so the lines I cleared ten feet broad and fifty feet apart were cut in a direction from north-east to south-west. This permitted the sun to strike on the clearing only three hours a day during the six hot months; had I followed the contour of the mountain side, the full strength of the sun would have been felt for six or eight hours a day, and my attempt would have turned out a failure.

Everything was ready before the sowing season arrived, which is as soon as they ripen in the early part of November. The seeds were selected from mature and healthy trees growing in much the same soil and aspect as the mountain side on which the sowings were to be made, which may have been an unnecessary precaution.

The sowings were carried out in the following manner:—A man was placed on the top of each line, and he made, at right angles with the slope, a cut with the pickaxe two feet long by six inches deep, then a downward cut from the centre to allow of drainage; this was repeated at intervals of five feet. He was followed by a cooly with a *kilta* of prepared soil, being equal parts of rich earth and vegetable mould, which he put into the cuts, filling up to within an inch of the top. Another cooly carefully sowed the Deodar seeds, a dozen in each cut, covering them lightly over.

The success was perfect, the seedlings, when eleven months old, stood nine inches high.

Another experiment was made under quite different circumstances,—here the mountain side was more or less grassy, no trees but a few shrubs and scattered patches of brushwood. The aspect being north-east, the lines ran north and south; the results were, cuttings under shade a success, the rest an unmistakable failure; had I sown the "Blue Fir" on the exposed places, all the sowings might have turned out equally well.

My experience may be of use to some, so I have noted down

460 INFLUENCE EXERCISED BY TREES ON THE CLIMATE AND

these few facts, feeling that we should all contribute what we can to the general stock of information, and regretting that I have hitherto done but little to that end, I beg to sign myself

ROBIN HOOD.

Influence exercised by trees on the climate and productiveness of the Peninsula of India.

TO THE EDITOR, "INDIAN FORESTER."

SIR,—The October 1879 number of the *Indian Forester* opens with a paper bearing the high sounding title—"Influence exercised by trees on the climate and productiveness of the Peninsula of India." It is a subject in which there is room for a good deal of work, and to which the field may now be said to be opening, with the creation of artificial forests, and the improvement of the natural ones. The effusion is one which it is surprising to find has not aroused professional ire in the succeeding number of the *Forester*. Between the practical man who wants a high forest for his money, manufactured under his eye, and the muddy floods of weak science and wrong-headed observation let loose by way of advocacy, it is no wonder if the cause of Forestry suffers in public estimation. It is to be hoped that the House of Commons, in their coming enquiry on famine, will get hold of more convincing evidence than this paper affords, and that some one will be there to whisper that it does not "show what has been done since the Court of Directors wrote their despatch" in July 1847. A friend has suggested that the paper under review was printed in the *Forester* as an after-dinner joke, for camp reading, but there is nothing editorially to support his assumption. We have an array of antique facts and fallacies refurbished and weighed with the important air of a man announcing a new discovery of benefit to his fellow mortals. Really, through the whole paper there is hardly a fact of any novelty, and one cannot help wondering what like were the scientific men of those days with their cumbersome verbiage, their airy dogmatism, and their scant knowledge of nature. If Drs. Gibson and Balfour, writing of a time before many of us were born, would

simply give us a description of our forests a generation ago, what a different value their writings would possess.

After much correspondence and discussion the learned author of the paper arrives at the conclusion "that the bareness of the Bellary district is a cause of its aridity."

This is much like saying that the inferior quality of the shoe leather worn by the little boys about town is a cause of the noise in the streets. Then follow twelve propositions, most of them not applicable to tree life in the Peninsula, some gross exaggerations, and others as novel as they are untrue. Take for instance (11)—"that the tenacious clayey undersoil, found in forests, is peculiarly adapted for preserving surface and subsoil waters;" or (5) "that the forest trees which grow on mountain summits have a structure peculiarly fitting them to receive the waters of the clouds." Trees now-a-days do not much affect the *summits* of mountains. It must be a matter of regret to us all that no fossil remains have yet been found exhibiting this cloud-catching structure, the more so since modern invention and research has supplied such an excellent term of comparison in the *Pithecolobium Saman*.

Proposition (4) is equally startling. "That mountains, practically when covered with their native forests, by an electric action on the atmosphere, cause clouds to gather around them, condense and collect the vapours of the air, and equalize the fall of rain." Electricity now has ceased to be the convenient force it used, invocable by every full-mouthed writer of reports for the ignorant. Further on at para. 16 the unfortunate Collector of Bellary is made to compare the plains portion of his district with the Rāmandroog hill, suggesting the inference that the clouds and mist on the latter are dependent on its shrubby forest. Now it is potent to every one that the clouds must be there, be there any forest or not. It is easy to argue that in this particular case there would be more cloud if there were no forest. The presence of cloud on isolated hills like the "Droogs" of Southern India is almost entirely the result of radiation. When a current of air moving horizontally meets a plateau or a continuous chain of mountains, it is forced to rise to a region of less barometric pressure, and the

arrival of the dew point is hastened by the air's own expansion. But on peaks the dew point is reached by the current of air parting with its heat to the peaks previously cooled by radiation. During the day the effect of radiation is marked by the interchange of solar heat. During the night it is a matter of thermometric observation that radiation is most active on grass than on bare ground, and least so under forest. Therefore, supposing two isolated hills to be radiating, side by side, during a clear night, one forest-clad and one bare, the latter would cool the faster, reach the dew point sooner, and show more cloud next morning than the former.

Of course the forest on the first hill would cause drip, but after all the drip from a tree in a fog is a very slight matter. It strikes the eye, but can very rarely be shown at all in a rain gauge. The forest springs so harped on in this paper and elsewhere are in similar case. Leaving out the zone of heavier rainfall, the utility—the yield of water of all the forest springs in Mysore might be put down as equal to a score of ordinary wells. It has yet to be shown that, bettering the forest will increase the yield or duration of these springs. The first result of the up-growth of forest is to distribute the sub-soil moisture more evenly. In rainy climates or with a weak evaporation, such as those in northern latitudes, there is a dripping of the spongy mantle and springs. In dry climates, or with a rapid evaporation as in the tropics, the moisture in the sponge is little more than capillary, and there is no dripping. This leaves out of the question the draining action of the forest itself. To return to Ràmandroog—: No one would deny that this breezy sanitarium would be better afforested than bare, (provided again that we are going to live above the forest and not below it), but Dr. Balfour destroys his case by misstatement, and by a badly chosen illustration throws doubt on the general truth that forests do cause increased cloud and precipitation of moisture.

Proposition (12) is another eminently cloudy one. Here "the vegetable creation," suggests the man with the shiny

head, plate in hand, before the sermon; "there is a difference in the condensing power of trees, but by means of the vegetable creation, a valuable supply of moisture is collected from fogs, and from the atmosphere in the form of dew." Then follow a number of truisms which one feels half inclined to doubt, presented as they are.

In discussing the rainfall of a station in Malabar, and of others afterwards, the figures are grouped in periods chosen apparently quite empirically. Some one else might take the same returns, group them differently, and demonstrate something else.

One would have imagined that at the time mentioned in para. 21 the less said about the Madras and Bangalore museums the better. Some years ago their collections of woods were models of confusion. Often the only guide to an unsightly hunk was some out-of-the-way vernacular name wrongly transliterated. There were reasons for this state of things then, and they are altered now, but to take credit for bad work is little better than injuring Forestry by amateur writing.

It is not clear how the observations of Ebermeyer and "that learned man" Max von Pettenkofer, apply to the dry forests of Southern India, where during the greater part of the year there is no appreciable evaporation to be checked or rainfall to be controlled, by forests, and where their main action is that of a drain or subsoil moisture; or what indeed a microscopist has to do with this class of phenomena at all.

At the top of page 134 there is a bit of rank nonsense—"The shade of a single tree, therefore, cools, not only by intercepting the sun's rays, but *also by the effect of gentle fanning.*" The italics are ours. Over and above its mechanical effect as a screen from the sun's rays the cooling action of foliage is chiefly due to the conversion of solar heat into chemical energy involved in the decomposition of carbonic acid, and this, one must charitably suppose, is, what is meant in the pamphlet though the misquotation or misapplication seems extraordinary.

At para. 41 is given a list of what trees to plant. With four exceptions it is a fair list of what not to plant. Then we

are calmly told "the several species of *Eucalyptus*" (there is safety in numbers) "from Australia, grow with great rapidity in the Neilgherry Hills, and might be largely utilized." As if there were any inference that what suited the climate of the Nilgherries would be of any use for Southern India generally. Up to the present time no species of *Eucalyptus* has been found hardly on the highest part of the Mysore plateau. Then come jungle fires, which are discussed with a touching ignorance of them. Apparently some stern person is to "prohibit the firing of forests and hill tracts," ruling fire, like Britannia does the Ocean. Sheep, goats, cattle, and woodcutters are also to be excluded, the authority for this novel measure being no less a person than Mr. Darwin himself who would doubtless feel far from flattered at seeing his name in this connection.

Apparently the association was gratifying to the author of the pamphlet for a sprightly tone becomes here evident. A traveller who indulges in swearing is brought upon the stage, and presently we lose the forest tract amongst non-Arian settlers, present populations to the square mile, and vast irrigation schemes.

On some Woods and Wood-products in common use in Japan.

(From the *Timber Trades Journal*.)

WE are indebted for the following information to an interesting Report on Japanese Forest-Products, lately drawn up by a French naval officer employed in the Japanese Arsenal.

Wood used in Turning.—Large articles, as window-frames, door-posts, and the legs of tables and similar articles which have been introduced with European fashions, are turned in Keaki (*Planera japonica*). So also are the wooden platters in common use all over the country, the makers of which mostly prefer the sap-wood to the heart. Small camps of these men may be found in the woods, surrounded by the trees they have felled, and of which they only use the outer portions, leaving the heart-wood on the ground to perish. Sometimes

the platters are lacquered; but most often they are simply oiled. A cheaper kind is made of beech wood. Articles are turned in the following:—White wares, first quality:—*Buxus japonica*, *Torreya nucifera*. White wares, second quality:—*Ilex aquifolium*, *Ilex latifolium*. Coloured wares, hard:—*Distylium racemosum*, *Aronia asiatica*, *Ternstroemia japonica*. Coloured wares, soft:—*Prunus pseudocerasus*, *Prunus M'me*, *Hoiceltis aspera*, *Sophora japonica*.

Wood Printing.—Until the introduction of metal type about ten or twelve years ago, Japanese printing was performed entirely with wooden blocks. But European type is ill suited to native characters. The diversity of characters requisite to express but a very limited range of ideas is opposed to its use, which moreover necessitates the employment of paper of a different quality. Hence, the art of wood-engraving flourishes as much as ever. Several native newspapers are "printed on wood." Cherry and *Ilex crenata* are the woods most used. But these are unsuited for seal-engraving. Seals, it should be observed, are very generally used in Japan as substitutes for autographic signatures, and the sigillograph is the object of as much consideration among officials and business men in Japan as the signature in Europe. The choicest and finest cut seals are in beech or camellia wood. In custom-houses and such places, large seals of weeping willow or poplar wood are used.

Carving in Wood.—The woods chiefly used for carved work are Ninoki (*Retinospora obtusa*), where the carving is to be lacquered, and Keaki, (*Planera japonica*), where it is to be left plain or oiled.

Woods for Cooperage.—The Japanese are very skilful coopers. Barrels and casks of all sorts up to huge vats holding 100 hect. (2,200 Eng. galls.) are constructed without the aid of iron hoops. They make a point of using the least hygrometric woods for this purpose. For large casks and similar utensils, two species of *Retinospora*, known respecting as Ninoki (*R. obtusa*) and Sawara (*R. pisifera*) are especially esteemed: Segni is a fairly good wood for the same purpose; Momi (*Abies firma*) is of inferior quality. These are the resinous woods.

Among those of foliage trees are used Keaki, Kachi, a generic name for all kinds of evergreen oak, of which there are numerous varieties in Japan, Kouri or Japanese chesnuts, chiefly used for dry goods. For smaller utensils the woods of *Torreya nucifera*, *Ginkgo biloba* and *Juniperus rigida* are employed. There are also numberless small articles, some highly finished and lacquered, made of Ninoki, tohi (*Abies alcoquina* Parlat.), Sizabi (*Abies Veitchii*) and Sawara (*Retinospora pisifera*). In general use too are malt-buckets of cedar; huge tanks in green cedar for holding manure, solid or liquid, and, last but not least, baths. The hotbaths are used daily by Japanese of all ages and degrees; and the utensil which serves the purpose in private houses is an eminently practical contrivance, which might find useful application elsewhere. It is an oval tub, rather wider at the top than the bottom, the diameter being about 31 in. and 24 in., and the depth 28 in. The bather squats in it with the knees drawn up towards the chin, so that a comparatively small quantity of water suffices for complete immersion of the whole body. The seams are rendered watertight by a light caulking with chesnut bark. A small iron stove, shaped like a flower-pot and 9 in. in diameter, is inserted through an opening in the side so as to project about 10 in. into the interior of the tub, and serves as a heater. The wooden sides and bottoms assist in the accumulation and retention of the heat, so that without other aid than the heater, a bath of this description can be got ready in less than half an hour. In suitable wood, as *Torreya nucifera*, it will last, it is said, thirty years, or in Kinoki ten; but three years is the usual duration. In bath-houses the baths are usually rectangular wooden tanks, allowing a number of persons to bathe at once. Each bath-house has one, the dimensions depending upon the custom expected.

All Japanese cooperages take the shape of truncated cones, the staves being kept from slipping by the insertion of bamboo splints, and the place of hoops supplied by rings of plaited bamboo rope, put over the smaller end and "set up" with blows of wooden mallets. Where handles are supplied they are cylindrical pieces of smooth wood with the ends inserted in

holes in two opposite staves, which are left longer than the rest for the purpose.

Guettas.—In place of overshoes or *sabots*, the Japanese use the high wooden pattens, with which pictures have rendered us familiar, and which are called "Guettas." Unless very light, these are cumbersome and impede walking; preference is therefore given to Kiri or Paulownia wood (*Paulownia imperialis*), which is grown in a particular manner for the express purpose, and is as light as cork, having a sp. gr. of 0.200. The wedge-like supports are made generally of oak. The name Kiri is often applied to the wood of the Japanese oil tree (*Elaeocarpus verrucosa*), but this material is very inferior. Ho (*Magnolia hypoleuca*) is sometimes used for fancy guettas, for the sake of its pretty appearance.

Boxes.—Boxes and chests are generally constructed of Paulownia or camphor wood, both of which are reputed damp and insect-proof. Travelling trunks are generally made of wicker-work, covered with oiled or lacquered paper. Preference is given to withes of weeping-willow over bamboo, as the former swell with the damp and close up all interstices. They will not bear rough usage, but are light and handy beyond European comparison.

Nails.—As a rule the Japanese reject the use of iron nails in wood-work, as discolouring the wood, an objection not without force in a damp climate, where wood-work is usually left unpainted. Instead, they employ trenails of the wood in use, or where some other is needed, of bamboo, *Deutzia scabra*, or *Derrvillea japonica*.

Tool-handles, Blocks, Wedges.—The woods chiefly used for tool-handles are various kinds of oak: *Torreya nucifera*, *Olea aquifolia*, *Fraxinus longicuspis*, *Sophora japonica*, *Erobotrya japonica*, *Photinia villosa*. Carpenters give the preference to Sophora wood. Chopping blocks and wedges for splitting wood are generally made of the heart of some kind of oak. Oars, too, are made of oak (*Quercus acuta*).

The Mohwa Tree

(*Bassia latifolia*)

IN THE CENTRAL PROVINCES.

THE importance of this tree is so great that it seems desirable to make more generally known to Forest Officers the results of an enquiry set on foot by Mr. J. G. Nicholls, C.S., the Commissioner of Excise at Nagpur.

The tree is abundant in all parts of Central India, from Guzerat to Behár. It is indigenous in the Sâtpúra and Vindhya Ranges. It is found also in Eastern Kumaon and in Oudh. It thrives on dry stony ground and attains a height of 40 to 60 feet. It is protected but not artificially planted.

In 1878 Mr. Nicholls asked the Deputy Commissioners of the Central Provinces to enquire about the number of trees that survive, whether they were replaced as they died off of old age, and what was the price of the mohwa flowers, which are used, as is well known, both to distil spirit from and to eat as food.

Mr. Fernandez remarks:—

“The hill tribes of the Nimar, Hoshangabad and Betul districts depend for a considerable portion of their food-supply on forest fruits and other produce. Of these the flower and fruit of the Mohwa tree are the most important, both on account of their highly nourishing properties and the large quantities in which they are consumed. Except when variety is required, or when the ber is still in season, the sun-dried mohwa flower forms a part of every meal, being eaten with boiled rice, and with the lesser millets kneaded into dough to make bread. The proportion of sugar in the fleshy corolla is exceedingly large, combined with a small quantity of some nitrogenous compounds. This gives it great nourishing powers, and its general use effects a considerable saving in the consumption of cereals. I am unable to state exactly what this saving is, but it cannot be put down at less than 20 per cent., after making allowance for the increased quantity of cereals consumed on account of the improved flavour imported by it to the latter.

“The seed of the mohwa, or rather the cotyledons of the seed, contain about 25 per cent., by weight of oil. This oil is expressed by the hill people themselves by a very simple process. The testa or skin being removed, the seed is pounded and boiled, wrapped up in two or three folds of an old blanket and pressed between two boards. Besides being used for lighting, the oil forms a very inexpensive substitute for ghee, which it resembles in colour and consistency. Taking the flower and fruit toge-

ther, a provident family can live well and save at least 30 per cent. of cereals by laying in a sufficient supply of these products for the year's use."

In *Saugor* it was found that the tree is self grown. The drought of the last two years has been injurious, and many fine trees have been seen drying up.

In former days the produce of Mohwa trees, as well as of the Achar (*Buchanania latifolia*—the kernel of the nut) was regarded as the common property of the village, and so the trees were cared for and never injured. Now the *mālguzār*, or proprietor of the village, has arrogated to himself the right to dispose of the produce, just as Government does in the *Reserved Forests*. The villagers, therefore, do not care to protect the trees *nor do they hesitate to destroy young seedlings* which would come up and replace the older trees. No artificial reproduction is attempted.

In *Damoh*, the Deputy Commissioner remarks that the villagers never plant the tree artificially, but thinks that much may be done to preserve the trees that exist, some of which suffer from a thorny climber and from a parasite called "Banda" (possibly the *Cuscuta*?) The cutting of the tree is forbidden on village lands, but there is *no penalty attached*.

In *Balaghāt*, the Deputy Commissioner attempted to get the landowners to sow seed, but does not say whether he had any success. The tree he says is rapidly disappearing, because the seedlings are destroyed whenever they are outside the forest, the land having been brought under cultivation, and only the Mohwa trees left.

In *Betul* and *Hoshangabad* it is said that the trees are everywhere respected. In *Wardha*, also, it is said that the tree is increasing and not diminishing. The district officers do not give leave for trees to be cut till they are past the fruit-bearing age. Young trees are coming on much faster than the old ones are disappearing. But in *Chhindwāra*, which lies alongside of *Betul*, the account is not so encouraging.

The Assistant Conservator of *Nimar* caused an enumeration to be made, the total results for *Chhindwāra* being 219,155 trees, of which 178,980 were old trees and 45,175 young.

In *Chānda*, it is said the tree is ruthlessly destroyed owing

to the long established custom of making irrigation pipes (out of tanks, &c.) of Mohwa wood: a trunk is hollowed out like a canoe, and then a slab of wood is laid on the top, and the whole surrounded by clay: thus a wide pipe is formed. No other wood, it is said, would stand the action of the water. The Deputy Commissioner offered to get iron pipes from Bombay, which could easily be done, but 'custom' was, as usual, against him.

All that could be done was to protect the trees where they occurred in the Government forest by putting a price, Rs. 4, on each log, which, though not high, to some extent limited the demand.

In the Marátha times, it is said to have been common to cut down the Mohwá trees in the Bhil country so as to afflict the lawless hill tribes and reduce them to straits. Mr. Nicholls says that this shows how greatly the hill tribes depended on the produce of the trees for food.

The following is taken for Mr. Nicholls' *Excise Report* of 1878-79. Appendix D.

"I have received the following account, based on the experience of the Native Assistant Commissioner for the Balaghat district. Out of a total population of 325,000 people, about 100,000 people use mohwa as food from June to April, and between 70,000 and 80,000 maunds of mohwa are thus consumed; the daily allowance may be stated at about 4 chutacks.

* *Bombax malabari-curr.* Of the minor forest produce about 5,000 maunds of Semal * and Kanhikund † are used for food.

† *Tacca pinnatifida.*

About 80,000 maunds of cereals may be deducted. That is, it is estimated that the saving of cereals through the consumption of the crops of mohwa and forest produce amounts to 2,962 tons annually. My own impression is, that it is very generally consumed in ordinary years, from the middle of May to the end of September, and then forms about a third part of the food consumed by those who at all use it as food.

The Deputy Commissioner of SAMBALPUR writes:—

"There is at present not sufficient information to enable me to submit an estimate of how many people make use of mohwa as food. Mr. Russell (late Settlement Officer), while out marching, evidently made some enquiries, for in his diary of the 10th February, he writes:—

"Here the staple rice is supplemented by mohwa, which in the jungly parts constitutes the only food for about two months, sub-jungly for one month; other grains, beans, &c., for another

month; and in the very wild parts, roots and tubers resembling (in appearance only) sweet potatoes.'

"The Raja of Rehrakol told me that in his state no one ever died of hunger, because the jungles furnished ample supplies of fruit, roots, leaves, &c., on which they subsist, when grain is scarce and not within their reach.'"

The consumption in the Balaghat district of mohwa has been estimated at 80,000 maunds a year. In Bhandara it is supposed that 18,000 maunds are consumed between April and September by one-eighth of the population.

The Deputy Commissioner of OHHINDWARA writes:—

"In the Southern Tahsil mohwa is consumed in ordinary years by 6,000 persons in Cheyt and Bysakh, each person consuming one kuru per mensem, or a total consumption of 3,000 maunds.

"In the Northern Tahsil it is consumed from Cheyt to Srawan, and a total consumption is estimated of 10,000 maunds."

For my part, I think that none would be consumed in Cheyt or Bysakh, and that the quantities are vastly under-estimated.

The Deputy Commissioner of SAUGOR writes:—

"About 90,000 maunds of mohwa are consumed by the poorer classes during the rains, i.e. July, August and September, when the food, possessing heat-producing substances, does not prove injurious to health but is rather stimulating and beneficial, the number thus consuming mohwa being estimated at 65,000 out of 527,725 souls, or one-eighth of the population.

"In the north of the district, such as Baretha, Shahgarh, &c., the lower classes live mostly on mohwa and forest produce.

"The following jungle products are largely consumed by the people:—

Ber (<i>Zizyphus</i>),	Achâr (<i>Buchanania latifolia</i>),
Koranda (<i>Carissa diffusa</i>),	Makhora (?),
Tendu (<i>Diospyros Melanoxylon</i>),	Umar (<i>Ficus glomerata</i>),

said to be about 42,000 maunds during the year. There is probably a saving of about 165,000 maunds of cereals consequent on the consumption of mohwa and forest produce noted above."

In the southern tahsil of JUBBULPORE it has been estimated that 33,000 people consume mohwa between March and September, using 37,000 maunds; and that this replaces 75,000 maunds of cereals. Other forest produce is consumed as fruit, not as a substitute for grain. The consumers are mostly Gonds, Pardhans, and Patharis. In the Sehora Tahsil about 20,000 people consume mohwa from July to October, using 33,000 maunds, thus saving an equal quantity of cereals.

In the northern or Murhwarah tahsil about 27,000 Kols, Bharias, Gonds and Bassores in this season are supposed to

consume 25,000 maunds of mohwa and 20,000 maunds of other fruits, thus saving 20,000 maunds of cereals.

Major Temple for NIMAR writes:—

"The following classes, Bhils, Bhilals, Kolis, Kurkus, Nahals, Gonds, Meenas, Balahis, and Mhangs, for four months of the year, exist almost entirely on mohwa, even making cakes out of it, and my enquiries further lead me to believe that not less than a quarter of the agricultural classes also for four months of the year exist on mohwa. Other minor jungle produce is gathered and consumed too, but in comparison to mohwa is insignificant. Taking the above and estimating the consumption per head at 2 maunds, we arrive at the following results:—

Bhils, &c., as per census	...	...	40,000
Agricultural classes, including servants, one-fourth of total	...	...	13,000
		Total	53,000

"This figure multiplied by 2 gives us 106,000 maunds, and in calculating the amount of saving through consumption of mohwa, I think at least the above number of maunds might well be deducted from the total quantity of cereals consumed."

For SEONI it is estimated that in ordinary times about 6,000 maunds of mohwa are annually consumed by the poor people in the district, chiefly during the months of Srawan and Bhadon, and 18,000 by the cattle. There are about 16,000 persons* who use it. In years of distress the number of consumers increases considerably, and the quantity of mohwa, which in ordinary time is given to cattle or used otherwise, is largely substituted for human food.

There are no other forest products in the district which can be used as an article of food. Of course tendu, char, &c., are eaten by the people generally when they are ripe, but these can hardly be said to afford any substantial relief to the people in times of distress. Gonds and other classes accustomed to live in the jungles, also devour many kinds of roots and bulbs which are not known to the mass of the population.

6,000 maunds of cereals may be calculated to be the quantity saved in an ordinary year on account of mohwa being used as food.

For RAIPUR the Deputy Commissioner writes:—

The total population of the district, as per last census, is 1,093,405, and of this number about 40,000 people, as a rule, Gond, Binjwar, &c., &c., use mohwa for food, and the quantity consumed by them may be estimated at 40,000 maunds yearly. During the months of June, July, August, September and October, the mohwa is chiefly used, as at this season of the

* 16,000 persons will consume 6,000 maunds of mohwa in two months at $\frac{1}{2}$ seer per day. It is to be understood that the food of the poor people generally consists partly of mohwa and partly of grain. Mohwa alone is seldom used as food.

year the stores of grain run low, and it is necessary to eke them out as best they can. No other minor jungle produce is largely consumed by the people as food, though of course chironji, ber, tendu, &c., &c., supplement the ordinary food-supply of the people in the wilder parts of the district, when they are in season; 40,000 maunds of cereals may therefore be struck out from the total quantity calculated for the district on account of mohwa."

Mr. Bartlett has given me the following account for SIRONCHA:—

"Mohwa is consumed for five or six months in the year, that is, from March to August, by about two-thirds of the population of this district. From this I infer that about 70,000 maunds of mohwa are consumed ordinarily by the inhabitants of this district every year. The fruits of tundki, ber, palmyra, &c., a root called "samagadhi" and other roots, the leaves of many kinds of herbs and plants, and certain grass seeds are consumed by two-thirds of the people here. They are eaten in ordinary years, from July till October. I should say, that supposing the average consumption of grain were put down at 5 maunds per person, were he to exist on grain the whole way, about $\frac{2}{3}$ maunds could be deducted for two-thirds of the population of this district by reason of the consumption of mohwa, and other jungle produce."

Major Ricketts supplies the following estimate for HOSHANGABAD:—

"The quantity of mohwa consumed by the people throughout the district may be estimated at 112,500 maunds. It is very difficult to give a correct estimate, since no statistics are available. It is merely an estimate calculated on the number of Gonds and other classes who generally consume mohwa. It is used by the people for nine months of the year, save October, November and December. In ordinary years it is used by about 50,000 people out of the total population, 449,000 souls. Mohwa is generally used by Gonds, Kurkus, and other low classes. Other minor products of the forests are not largely used for food by the people, but some roots (called khands), chironji, and other minor products are used with other food to a small extent.

"About 225,000 maunds of cereals should be deducted as a saving on account of consumption of mohwa."

The WARDHA account is as follows:—

"In this district in ordinary seasons, mohwa and jungle products are not used as food to the extent of becoming a substitute for cereals. Mohwa does not even enter largely into the dietary of the Gonds of this district. In May and June it forms an ingredient in an occasional meal, or is eaten parched like gram, but it does not in any important degree take the place of cereals.

"For one thing mohwa here commands about three-fourth the price of jowari, which is the common food grain of this district.

"Jungle fruits and products are taken more as a relish, or extra, than as a substitute for a regular meal. It would be different in famine times, but the data for an estimate of the consumption under such circumstances are wanting. It would not I think be safe in the case of this district to make any very large deduction on account of relief to be expected from this source in the event of famine."

Colonel Ashburner, the Deputy Commissioner of NARSINGH-PUR, has carefully considered this subject. He is of opinion that "it is chiefly consumed by the Gonds and other hill tribes. The total number of aboriginal or hill tribes in this district according to the last census returns is 43,332. The mohwa is chiefly used as food during the rainy season. It is not taken alone, but is mixed with the flour of some cereal, and after being well pounded is then boiled in a large quantity of water. The preparation is called 'pench,' and then about a pound will suffice for a whole family for one day; besides mohwa the only description of forest produce which is stored as food is the chironji nut. The supply is generally plentiful, but it is generally eaten more as a delicacy than as a regular article of food."

The Deputy Commissioner of NAGPUR, Mr. F. Venning, C. S. writes thus:—

"The only information I can give on such short notice concerning the consumption of mohwa is the following:—Mohwa forms a portion, perhaps one-third part of the diet of the Gonds and of certain low castes, such as Dhers and Dhimars, during 6 months of the year, during the rains and cold season, or from July to January. What the numbers of the people who habitually consume mohwa are, it is impossible to say. According to the last census there were close upon 100,000 Dhers in this district, but it is quite clear that they do not all consume mohwa. Only those probably who inhabit the less thickly populated parts of the district consume, to the extent above indicated, *i.e.*, to the extent of about one-sixth of their total food-supply. To take the numbers of these castes and to assume that they all consume mohwa to the above extent, would be most fallacious. My informants have estimated the proportion of the population who habitually consume mohwa variously at 1-16th and 1-32nd. Such guesses are obviously of very little value. Supposing we adopted 1-20th we should get about 33,000 people consuming about 1 maund annually. Probably the quantity annually consumed as human food is between 10,000 and 50,000 maunds.

"There are no data at hand for making any closer estimate than this. No other jungle products enter appreciably into the food-supply of the people."

The concluding extract is Mr. Nicholls' note on the subject generally. He perhaps over-rates the value of the flower as a good and wholesome article of food, but that does not diminish its importance, as an aid in famine time :—

Note by Mr. Nicholls, C.S., on the value of Mohwa produce of the Central Provinces, and the prospects of the future supply.

The dried mohwa flower affords a nutritious food, which is consumed more or less in all years, by probably not less than 1,400,000 of persons belonging to our wildest and poorest classes, including the children of the families in whose houses it is used. These people reside in localities the most distant from towns which could be made centres of relief in time of famine.

In a time of scarcity, if mohwa were procurable, it would go far towards sustaining an additional number of our population equal to the habitual consumers.

From my enquiries, I am led to believe that one maund for the annual consumption of each individual is a moderate and quite safe estimate. But one maund of mohwa sets free more than an equal weight of grain, probably one and a half maunds.

Mr. Fernandez, Assistant Conservator of Forests, has given this matter his special attention. He calculates that a frugal family will save 30 per cent. of grain on the average annual consumption of cereals by the partial and seasonable substitution of mohwa flower and oil.

I will first estimate the saving to be only $1\frac{1}{4}$ maund of grain for each person, 5 maunds being the annual average consumption of each individual of the population. This represents, 1,750,000 maunds of grain saved, or we may calculate in another way, that this supplementary source of food supply sets free so much of our arable land as would be required to produce an extra 1,750,000 maunds of cereals, to be more profitably employed in the cultivation of cotton, linseed, and the more valuable agricultural products, resulting in a still larger balance of trade in favour of these Provinces.

But so as to be sure of avoiding an over estimate, suppose the saving to be only 1,250,000 maunds a year, this sets free so many maunds of the highest priced grain mostly for export out of the Provinces. Calculating at 20 seers to the rupee, this would represent one quarter of a million pounds sterling as the value of the mohwa crop to these Provinces in ordinary years, exclusive of what is used for distillation. The latter want will always, in ordinary years, be first provided for, because good prices would be forthcoming.

The mohwa used for distillation yields a revenue of close on ten lakhs of rupees a year, raised, in a way, by self-imposed

taxation on classes who could not otherwise (save by the salt tax) be made to pay their quota towards the expenses of the State.

At the lowest valuation, in ordinary years, the mohwa produce is worth to the country at large, not less than 35 lakhs of rupees.

In times of scarcity its economic as well as its monetary value rises with the intensity of the distress: it becomes of vital importance. It must be remembered that failure of agricultural crops in these Provinces is more frequently the result of excessive rain-fall than of drought. The mohwa crop would be unaffected by an excessive rainfall in the period of the monsoon. It suffers from drought to some extent, more so from frost. Were but for this supplementary source of food supply, we should experience famines, with it we should only have distress. Without it, I think we should always have chronic scarcity in the wildest parts of the Provinces.

We are now called on to part with a portion of our crop for export to Bombay. It is understood that besides the demand in that direction for the purpose of distillation and for consumption as food, it is also required for use in the manufactures in connection with ship-painting and caulking. I have no reliable information on this point. I mention what I have been told for what it may be worth. But at any time demands may arise at the bidding of the chemist and the manufacturer in quarters where the purchasing power would be so great as to draw off much of our crop. It is not unlikely that the distillers of the North-Western Provinces will soon begin to indent for mohwa on our northern districts.

Taking the lowest valuation of the crop, *i.e.*, 35 lakhs of rupees, and capitalizing this at 15 years' purchase, we get the present value of the bearing trees, as flower and oil producing-sources, represented by 5½ millions sterling.

But to replace the present existing trees in full bearing would require much more than 15 years. Considering this, and the cost of artificially stimulated reproduction together with the incidental disturbances of the normal conditions of life, double this amount would scarcely compensate the Provinces for their sudden destruction.

This goodly endowment from the hands of bountiful nature, this inheritance may not with impunity be wrecked or impaired. It should be held as a great trust, to be left at the least intact by the present generation for the support and enjoyment of generations yet unborn.

I have collected and respectfully submit the observations of some of the Deputy Commissioners and Forest officers. Opinions vary. It seems that in Chanda no longer can a fair sized tree be found save in the Government forests. In Chhattisgarh, west of Mahanadi, the tree has all but disappeared. In Saugor, it seems to be on the way to disappear.

At the foot of the Satpuras in the Narsinghpur and Hoshangabad districts, and again in the Katangi Kerola sub-montane tract there are scores of miles of park-like country studded with these now magnificent trees, all the more striking to the eye, because they alone remain standing in the fields and fallows. No doubt they were mostly self-sown and grew up under the protection of surrounding jungle. But now that there is no longer any friendly jungle around them, no young trees are coming forward, and these old trees, dating probably from the days of the Pindhari desolation, will but little longer continue to flower and yield fruit. Probably the great majority of them are of about the same age, and it might well happen that they simultaneously cease to flower and bear. If this were to happen and no provision elsewhere should have been made against this contingency, it would be a serious matter for many tens of thousands of people—I may say, it would be a calamity.

I have traversed with my eyes open no small portion of the Central Provinces, and am not unacquainted with the Wardha district. The account given by Mr. Drysdale—that the number of trees is increasing rather than decreasing is, I fear, too sanguine, too good, even for that district. I have noticed only one tract of country, the almost virgin forest in the eastern Zemindaries of Bhandara, which resembles Mr. Drysdale's picture of Wardha, and the accounts given by the Deputy Commissioners of Hoshangabad and Betul are not such as I had expected from my own observations. It was when travelling in the Betul district that the fears which led to the present enquiry began to arise in my mind.

For nearly a year and half this matter has received my close attention, and my conclusion is, that the gloomy views taken by two of my predecessors, Major Ward and Major Bloomfield, as well as by Major Plowden and Mr. Ellison, are a much more accurate description of the general condition of our mohwa trees than the accounts sent from Wardha, Hoshangabad and Seoni.

I can well remember having seen in 1873 many scores, I believe indeed, some hundreds of good mohwa trees, lying on the ground at one time within three miles of the city of Jubulpore, cut and sold by the Malguzar as fuel for burning lime and bricks. He was utterly regardless of the remonstrances and supplications of old women and old men, who from childhood had obtained from these groves a little help in the way of food to tide them through the cold, raw and often unemployed days of the rainy season. "The trees were written down as belonging to the Malguzar in the Settlement Book," that was enough for him to know or care for.

I am convinced that it is quite time to give close attention to this subject, and to afford far more encouragement for the renovation of this trust estate. Protection to young trees, as Mr. Fernandez clearly shows, is generally necessary.

478 EFFECTS OF DISFORESTMENT IN THE RHONE VALLEY.

As a protection against famine, I can conceive of no more legitimate object of the expenditure of some portion of the special famine insurance taxation than the systematic extension of the growth of this tree on Government waste lands and in the dreary, treeless expanses of central and western Chhattisgarh where reboisement is eminently required.

Effects of disforestment in the Rhone Valley.

Since recklessly they've felled the mountain trees,
Rain-swollen, roar the torrents to the plain;
Meadows, and fields, where peasants dwelt at ease,
Untilled, in lonely savagery remain.
With sand and boulders covered, not a blade
Of rye can grow, where golden crops of wheat
In happier times, enriched the fruitful glade.
Sleek cattle by the streams, in pastures sweet
No longer graze. The forest was the nurse
That slowly fed the streamlets, and forbade
Their gath'ring waters' downward rush to curse
The vales, mid steeps with beech, and fir-trees clad.
Doomed to present a wild and rugged scene,
Till nature's power restore the forest green.

W. R. FISHER.

The 17th March 1880.

Experiments on the Strength of timbers at Kandahar,

BY CAPTAIN CALL, R. E.

WE have received the following list of experiments made at Kandahar on different Afghan woods, by Captain C. F. Call, R. E. As far as we can ascertain, the following are the species experimented on :—

Chinar	... <i>Platanus orientalis</i> , <i>Linn.</i>
Banafsh	... <i>Praxinus moorcroftiana</i> , <i>Wall.</i>
Poplar	... <i>Populus euphratica</i> , <i>Olivier.</i>
Mulberry	... <i>Morus alba</i> , <i>Linn.</i>
White Willow	... <i>Salix alba</i> , <i>Linn.</i> (?)
Red ditto	... <i>Salix caprea</i> , <i>Linn.</i> (?)

The ash is identified by the fruits which were received from Captain Call.

One correspondent informs us that he has been planting cuttings of various trees along the canal banks at Candabar, and has even succeeded with cuttings of the Plane (Chinar.)

Specimens: 18 in. by 1 in. by 1 in.; supports 12 inches apart; load suspended from the centre.

No.	Weight per cubic foot.	DEFLECTION.				Breaking Weight.	REMARKS.
		After 16 hours.	After 4 hours.	After 1 hour.	After 1 hour.		
		350lbs.	525lbs.	600lbs.	700lbs.		
CHINAR.							
2	39.9	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$...	776	Broke straight across. Rather woolly section.
5	37.5	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	...	700
13	45.1	.25	.44	...	...	600
14	43.6	.30	...	...	...	525
36	38.9	.42	...	...	...	525
37	36.0	.42	...	...	...	525
38	37.4	.30	.55	...	...	600
39	40.4	.30	.57	...	...	600
40	37.4	.27	.35	...	...	600
41	35.25	.20	.29	...	...	600
62	35.9	.24	...	...	...	525
63	...	.23	...	...	...	525
64	...	.36	...	...	...	525
Total	427.3	3.54	2.63	7,626	
Average...	39.8	.27	.33	537	
WILLOW, CABUL (White)							
27	20.10	.195	.22	600	Very long fracture. The fibrous tissues adhere together more firmly than in the red willows. Broke nearly straight across. Large annular rings, tissues softer.
28	27.05	.19	...	...	...	525
29	28.50	.17	.21	.25	.35	800	
30	20.00	.19	.23	.27	...	700	
31	29.20	.19	.27	.30	...	700	
32	28.50	.14	...	...	...	525
42	27.00	.19	...	...	...	525
43	25.50	.19	...	...	...	525
44	26.90	.23	...	...	...	525
45	26.35	.18	.35	...	...	600
46	27.75	.15	.27	...	...	600
47	26.90	.16	.26	...	...	600
48	26.90	.19	.29	...	...	600
49	26.90	.19	.28	...	...	600
Total	388.25	2.56	2.38	.82	.35	8,425	
Average...	27.73	.18	.27	.27	.35	602	
BANARSH, (Violet Wood)							
11	55.6	$\frac{1}{8}$	525	Seeds enclosed.
12	57.0	$\frac{1}{8}$	...	...	...	350

No.	Weight per cubic foot.	DEFLECTION.				Breaking Weight.	REMARKS.
		After 16 hours.	After 4 hours.	After 1 hour.	After 1 hour.		
		350lbs.	525lbs.	600lbs.	700lbs.		
WILLOW, KANDAHAR, (Red)							
1	.....	...	...	$\frac{5}{8}$	..	627	
3	31.5	.25	...	...	...	604	
7	35.1	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{1}{2}$	...	600	
10	34.5	...	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	800	
26	28.8	.25	.45	...	...	600	
50	30.0	.45	1.13	1.27	...	700	
51	32.9	.48	...	...	...	525	
52	33.0	.48	1.00	1.26	...	700	
53	33.1	.89	.98	...	...	600	
54	31.5	.35	.99	1.15	...	700	
55	31.4	.21	.91	...	...	600	
Total.	321.8	8.25	6.07	5.05	...	7,056	
Aver- age...	32.2	.34	.76	.84	...	641	
POPLAR.							
8	28.5	...	...	...	...	350	
9	28.4	...	...	...	...	250	
15	25.6	...	...	...	...	350	
16	29.9	.19	...	...	...	525	
17	28.0	.24	...	...	...	525	
18	28.4	.15	...	...	...	525	
24	24.1	.15	.19	...	...	600	
25	28.8	.20	...	...	...	525	
33	27.0	...	...	...	...	350	
34	27.0	...	...	...	...	350	
35	25.5	...	...	...	...	350	
Total	299.2	.93	.19	...	...	4,700	
Aver- age...	27.2	.18	...	...	...	427	
MULBERRY.							
4	42.6	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	...	604	
6	...	...	...	...	...	350	
13	45.0	.33	...	...	...	525	
20	44.9	...	...	...	...	350	
21	45.6	.20	.22	.25	.28	850	
23	43.2	.20	.25	.25	.28	950	
56	41.9	.19	.28	...	...	600	
57	42.0	.18	.29	.39	...	700	
58	40.4	.19	.27	...	...	600	
59	41.9	.16	.29	.45	...	700	
60	42.0	.18	.28	.39	...	700	
61	46.5	.18	.34	.41	...	700	
Total	470.0	2.00	2.60	2.58	...	7,629	
Aver- age...	42.7	.20	.29	.37	...	636	

II. OFFICIAL PAPERS.

Forestry along the Railway Route in the Assigned Districts of Southern Afghanistan.

*Minute by Sir R. Temple, Bart., late Governor of Bombay,
dated 29th November 1879.*

THE Sibi route, through the districts assigned to the British Government by the treaty of Gundamak, having been recommended for the new railway, I have ventured to urge on the consideration of the Agent to the Governor-General (Sir Robert Sandeman,) who is in charge of those districts, the importance of providing for the conservation of the wood, timber, and fuel in the neighbourhood of the railway line. And I understand that it will be convenient to Sir Robert Sandeman that I should state my view, which I accordingly proceed to do.

As Sir Robert Sandeman and I have seen, the railway line from Sibi to Pishin passes through a hilly country which, though poorly and thinly wooded, and scantily clothed with vegetation, is far from being wholly woodless, and possesses resources of vegetation which, by judicious forestry, may be developed into forests, not large forests perhaps, but still forests of sufficient size for ordinary consumption.

So far as I can see there are not nearly the same destructive agencies at work among the woods and forests of these Assigned Districts, as there have been, and still are, in most parts of India. Still there are such agencies even in these districts similar in kind, though much less in degree, such as the burning of grass, the unrestricted grazing of cattle, and especially of goats, and the like. And although many of the rocky mountain sides are naturally bare and destitute of vegetation, still many of the hills, now very sparsely covered, must originally have been much better clothed than they are now. Still, despite all drawbacks, there are, in the districts through

which the railway is to pass, several kinds of useful trees now growing to an extent sufficient to show what the resources of the country must once have been, and what they might yet become—such as the “Gwanj,” which I understand to be a kind of sloe-tree in the Khwaja Amran range between Pishin and the Kandáhár Province; the juniper of the Adina Mountain and its neighbouring mountains; the sheeshum or blackwood; the babul (*Acacia arabica*) of the Dhungán range between Harnai and Thal; the wild olive of the valleys of Nari river and its affluents. Irrespective of these there are the more distant, though not too distant, forests of juniper on Mount Zerghun, of cedar and fir on Mount Ziarat, and other forests yet to be investigated—all which considerations are well known to the Agent to the Governor-General, and to which I need not further advert.

But with the approach of the railway there will arise a demand for wood and fuel, the like of which has never been seen or heard of in this part of the country. I do not allude to sleepers, which will be brought from elsewhere. But wood will be wanted for all sorts of buildings; fuel for lime-kilns and brick-kilns; firewood for the large number of workmen, employés in localities where the climate is very cold in winter. These demands must, if possible, be supplied on the spot. Then, there will be the demand of fuel for engines, as it is not likely that coal will be imported for this purpose,—a demand which, if not supplied on the spot, must be supplied at some expense from places as far off as Sind, but which it would be better, if possible, to supply on the spot. The result will be, that if some system of conservation is not established beforehand, all the trees now existing will be cut down, and not a remnant left for reproduction; even the very roots will be dug up. The tree-bearing lands will be so denuded in a year or so that they will never produce trees again. Indeed, so clean would the ground be swept by the besom of destruction that hereafter no one would believe that these valleys had ever been studded by trees at all. The probability of this amounting almost to certainty, has been established by manifold experience in India.

Some trees and some brushwood must necessarily be cut. But the object should be to so manage the cutting that enough shall be left for those natural processes of seeding and self-sowing, whereby trees reproduce themselves. A further object should be by artificial means, such as broadcast sowing and planting, to so augment the forest vegetation in the neighbourhood of the railway that all its wants shall be supplied locally without importation from a distance. For such forestry the abundant streams and streamlets fresh from the waterbearing strata of the mountains offer many facilities.

It is with special reference to the connexion between railway demands and local supply—the only point in which I am concerned—that I feel able to offer any suggestions to the Agent to the Governor-General. There are, of course, many other respects, such as the improvement of an extraordinarily arid climate, and of a very precarious rainfall, the better preservation of pasturage for the flocks of sheep and goats, and for the herds of cattle, in which forestry will be of service to this part of the country, and of which the Agent to the Governor-General is the best judge, and which require no remarks from me.

But in reference to the railway, I suggest the importance of immediately examining all the tracts having trees or lesser vegetation within a radius of a certain number of miles from the railway line—the length of the radius varying according to topographical circumstances; of settling any rights, interests, or tenures that the people may have in them; of summarily determining their boundaries, subject, if necessary, to formal delimitation hereafter; of placing a small, but trained, establishment of natives on moderate pay in charge of them, with instructions to permit cutting or grazing within them only under rules to be prescribed with regard to reproduction or to future augmentation of supply. Care, indeed, would have to be taken that the actual requirements of the villagers were not interfered with; but this would be satisfactorily settled by local arrangements. Now is the time to consider all this equitably in regard to both the State and the people, while the matter is still a '*tabula rasa*' in respect of

claims and disputes. Once the railway system has taken root in the country, all manner of allegations will be made by village headmen, instigated by contractors and other interested parties, which no one would now dream of making, and which hereafter may become embarrassing.

Similarly, arrangements would have to be made with the railway authorities. It is not that the engineer officers themselves directly encourage the destruction of vegetation; indeed, as enlightened persons they know perfectly well the importance of conservation. It is rather that the contractors, or, if not large contractors, the petty contractors who work under the railway authorities, and who, without the cognizance of those authorities, do on their own account, and for the sake of profit on their contracts, ruthlessly destroy the vegetation. I can assure the Agent to the Governor-General that instances of the above sort in India are too numerous to mention. Now is the time to prevent the beginning of mischief in these Assigned Districts, which once begun is hardly to be arrested.

If the Agent to the Governor-General should see fit to entertain a small establishment for forest conservancy, he will probably be asking for trained men from a distance. I regret that in this respect assistance cannot be afforded from the neighbourhood of Bombay, as the men of that quarter are not suited for service in the Afghán hills. Some suitable men could, however, be obtained from Sind, and, better still, some men could be obtained from the Punjab. Then the Agent to the Governor-General may justly be of opinion that a professional European forester ought to be immediately appointed to make a summary, but still so far a scientific inquiry into the forests and vegetation of the Assigned Districts, and to supervise, under orders of the Agent to the Governor-General, such native establishment as may be entertained. Such an officer could be obtained only from one of the Local Governments in India. I regret that the Bombay Government has so much forestry on its hands, now-a-days, that it could with difficulty spare such an officer even for a time. Perhaps the Government of India might be pleased to place such an officer at the disposal

of the Agent to the Governor-General. But if this be not possible, and if such an officer were still wanted, I would, if my Honourable Colleagues in Council should concur, endeavour to spare an officer from the Bombay Presidency, even at some sacrifice of convenience, so convinced am I of the expediency of the measure.

Further, I would draw attention to the experience which is being gained in several parts of India regarding the use of wood for railways instead of coal. On the one hand, if for the railways the fuel of the country is wastefully used up, then an unmitigated evil arises. On the other hand, if for the railways wood fuel preserves are created, then possibly the wood may be found cheaper than coal, in which case collaterally a public benefit certainly arises in that forests are created and maintained alongside the railway, and thus the vegetation of the country, instead of being retarded, becomes actually promoted by the railway system. This is the plan which is actually adopted in Sind; which is, I understand, being adopted in Southern India, and which is recommended for some parts of the Bombay Deccan.

Now it is probable that a similar plan, if tried alongside the new railway in the Assigned Districts, might answer very well for railway purposes, and would incidentally subserve the improvement of vegetation, which is a manifest desideratum in those districts.

Honesty in Jacobabad District.

Minute by the Governor of Bombay, dated 10th December 1879.

DURING my recent visit to the Jacobabad District, I was struck by the considerable space in the map filled by the patches or areas of preserved jungles or woods, for they can hardly be dignified by the name of forests.

The running of the new railway towards Afghanistan through this district as yet scantily stocked with wood, and through the neighbouring district of Catchi not stocked at all, gives additional importance to the question of a local supply of wood fuel. The question of wood fuel for the railways in Sind has been separately considered, and needs no discussion

here. But besides railway purposes there are numberless other purposes for which wood will be required in a district fast rising into prosperity from improvement of communications.

Arboriculture has been pursued with signal success in the Jacobabad District by the several Political Superintendents, General Jacob and his successors. But besides arboriculture in the sense of planting useful and ornamental trees, attention has always been given to the preservation of the spontaneous growth of vegetation. Of recent years this attention has been augmented, partly through the persevering advocacy of Major Macrae, the Conservator of Forests, and during 1878 the present Superintendent, Colonel Nuttall, obtained the sanction of the Bombay Government to formally conserve considerable areas of land as district forests to be administered by the District authorities (over and above the reserved forests administered by the Forest Department), and to entertain a limited establishment, of which the charges were to be defrayed by the fees leviable from those who got licenses to graze or to cut wood under regulation. These district forests would be 'Protected Forests' under the 'Indian Forest Act' of 1878; while the old forests, under the Forest Department, would be reserved forests according to the Act.

This arrangement has worked so far well that there are now some 14,200 acres in these district forests above mentioned, or something less than ten square miles, and the fees have yielded a considerable surplus over the charges of the watching establishments. Financially, therefore, it is practicable to somewhat further organize the establishment, or to improve the culture, by sowing broadcast the seeds of some better sorts of trees, or to enlarge the area. At present much of the district forest area is covered with the tamarisk only; but the seeds of the babul, the neem, the bahun, and other useful trees, might be sown. And after allowance has been made for much increase of cultivation, and for pasturage and the like, there remains in this district much land which might conveniently and advantageously be covered with wood, and thus by degrees a source of wealth may arise to the district.

Moreover, the Commissioner in Sind (Mr. Erskine) has drawn my attention to the remarkable development of the tamarisk jungle in the villages of the Indus in Upper Sind—many of these tamarisk trees having some considerable girth and rising to some height, so that in many spots the jungle might be called a forest. Indeed, we have all noted with pleasure the picturesque glades and woods of these localities; but Mr. Erskine has warned me that, notwithstanding the sparse population in Sind, even there destructive agencies are at work, which, if not checked, will soon clear the tamarisk off the face of the country.

If my Honourable Colleagues shall generally concur, I would encourage the Superintendent to develop the system of district conservancy, which has been so well begun, and to take up large additional areas, so far as this may be consistent with the rights of the people. The regular settlement in this district, which is pending at the present time, affords an excellent opportunity for such an operation, which opportunity, if now lost, may never recur. After all, an area of ten square miles, as above shown, though creditable as a beginning, is only a beginning, inasmuch as a considerable area of forest might be obtained in the thinly inhabited area of Jacobabad District, 2,000 square miles.

That the growth of the trees and brushwood in the Jacobabad District within the last few years has, in some degree, affected the climate, moderating the excessive heat and attracting more rain than heretofore, is the belief of the residents, both European and Native. I bear in mind that in many parts of Sind, forests and jungles are not desired (as they are elsewhere in India) as a means of improving the climate; it is held that the country receives all the necessary moisture from the inundations of the Indus; and that if rain be superadded (save in the hills on the border) more harm than accrues. But the case is considered by the local authorities to be different in the Jacobabad District: by reason of the proximity of the Catchi Province with its extensive tracts of aridity, either desert, or else thinly inhabited and scantily watered lands. Catchi, however, lying within a sort of semicircle of hills,

has always received some quantity of rain, whereas Jacobabad, lying just beyond the semicircle, receives very little. On the other hand, Jacobabad lies away from the ordinary course of the Indus, and in this respect is situated somewhat differently from the rest of Sind. The conclusion seems to be that in Jacobabad, especially towards its western portion adjoining Catchi, trees and vegetation are desirable, not only as a source of wealth, but also as a means of improving the climate.

But Mr. Erskine has pressed on me the consideration, that if, as we hope, large forest areas shall be demarcated in the Jacobabad District, and if the conservancy within them shall be scientifically undertaken, they must be entrusted to the care of the Forest Department. After some consideration, I entirely concur in this view; and if my Honourable Colleagues shall concur I propose to issue orders accordingly. Major Macrae, as Conservator, would have general charge, and the Assistant Conservator, Mr. Desai, would have immediate charge; but the co-operation and the general supervision of the Superintendent must be maintained, all which Colonel Nuttall will zealously afford. This can be arranged exactly according to the system which prevails in the rest of the Bombay Presidency. That this, the Assistant Conservator, while departmentally subordinate to the Conservator, would, in all executive matters relating to these Protected Forests, act under the direction of the Superintendent; he will be in direct official communication with the Superintendent, through whom he will submit all his references and his correspondence. If the Superintendent feels able himself to give orders on such a reference, he will do so; if not, he will submit it with his remarks to a superior authority. This plan is found in the Bombay Presidency to be the only one whereby the civil authority and influence of the District Officer can be combined with the professional skill and experience of the Forest Officers for the preservation of forests. It will doubtless have the same effect in Upper Sind.

I propose, if my Honourable Colleagues concur, that similar instructions be also communicated to the Collector of the Shikárpur District in Upper Sind, into which district, possibly, a like system may be introduced.

III. REVIEW.

The Journal of Forestry and Estates Management.

OWING to the late receipt of the December number, we have to confine our review at present to the three numbers ending with February 1880.

The editorial note (passing over a page of the usual nonsense about forest education) contains a just complaint of the state of things in the New Forest, and reviews the administration of the Crown forests generally for the year ending 31st March 1879.

Mr. BURROWS continues the paper called "Science for Young Foresters," which is in fact a very rudimentary account of the chief elements and their combinations with acids, &c.

Dr. BROWN has done good service by presenting us with a review of the French Forest Budget of 1880.

The establishment cost was to be about £227,545, which was nearly £4,000 more than in 1879. The increase is due to the success of the *réboisement* works in the mountains, and to the necessity for increase of supervision on extending these works on a scale somewhat more commensurate with their public importance.

New demands were being made for a "commission of reboisement" to prepare estimates and surveys for work in the department of Hérault, and was affected by the torrential affluents of the Orb and the Hérault, and for work in Savoy and on the basin of the Garonne.

For "constructions" (by which I think Dr. Brown means mechanical appliances, earthwork and masonry, or wood work, weirs, &c.) in connection with reboisement, and for works of actual planting and *gazonnement* or returfing, the estimate was £163,629, an excess of one million of francs over the last year's grant. This was passed after a review of the work that had been done, the committee remarking that it is better to spend a mil-

lion on reboisement work, than to spend it in compensation to people ruined by the action of torrents.

They budget for all "conservancy and working"—apart from the actual reboisement works—under the head of *Matériel du Service des Forêts*: the estimate being about £119,533. This includes tools, repairs, roads and fences, filling up blanks or other such cultural operations and also includes planting "dunes."

For "Instruction" the budget is £8,700 (cost of Forest Schools).

For "various expenses" £84,040 is entered; of which some would be spent in buying out forest rights, some in contribution by the Forest Department to the maintenance of certain roads which were useful to them, some for office establishments and travelling allowances, for expenses of prosecutions and for miscellaneous expenditure.

The *Receipts* are estimated at £1,595,117, and the total expenses at £1,488,500.

JANUARY 1880.—More "Science for Young Foresters" opens the articles in this number, and there are controversial articles on the planting of arable land, whether it is wise to put land under trees that might be used for cereal and other crops or not.

FEBRUARY.—The "Science for Young Foresters," goes in this number into geology, and describes the chief European systems of rock-formation.

The other papers are chiefly English in their interest; but there is one on the "Treatment of plantations without thinning" which will repay perusal. The author refers to a small plantation, which instead of being regularly thinned and so artificially spaced out, was left to form clumps here, and glades there, as it pleased.

The paper does not of course apply to *forests*, but it shows the fact that a different course of treatment may be applied successfully according to the different object in view, and that it by no means follows that a regular thinning which will answer for a small plantation of five acres, will be in all or even in most cases the plan to pursue in dealing with a *large area* which is required to be managed on *forest* principles.

The Timber Trades Journal.

THIS, the organ of the British timber trade, has for many years appeared as a fortnightly journal, but since the commencement of 1880 it has been made a weekly paper, and its interest greatly improved by a collection of articles on all subjects connected with the timber trade of Great Britain, and especially that with Russia, Norway and North America. In a batch of numbers before us—numbers which have appeared in the last three months—we find a large amount of useful information; and our 'notes' are consequently greatly indebted to it. The state of the timber market generally, the latest sales and prices obtained for different classes of timber, the newest inventions in wood-working machinery, and the reports from the forests where timber works are going on, all find a place in the new journal, while many most interesting long articles are found on subjects connected with the timber trade and with forest work.

In the numbers before us are interesting articles on the development of the timber-trade in Sweden, the forests of Northern Russia, and the trade with Siberia, on the woods used for making musical instruments, on the old timber roofs of English halls, and on many subjects of varied interest. The journal must now be of the greatest use to the timber trade at home, and we wish it every success in its new form.

IV TRAVEL AND SHIKAR.

Canoeing on the Western Ghats.

WYNAAD and Coorg may be said to be the fringe of the Mysore plateau. They are both terminated by the line of the Western Ghats. The western forests of Mysore merge imperceptibly into the eastern forests of Wynaad.

In fact the boundary between Mysore and Wynaad runs entirely through forest land, and at the best was originally a vague one. Since the formation of the Trigonometrical Map of 1838, several disputes have arisen, in every one of which Mysore has had the advantage, as is always the case when a dispute arises between Government and a Native State; so that at present at least one-third of the so-called Wynaad teak belt, according to the Trigonometrical Map, has lapsed to Mysore.

A large block of some thirty-five square miles in the very heart of the teak belt was given to a temple: so that the area of the Government teak forests is considerably less than it was held to be on the formation of the Forest Department. Wynaad forms part of the Malabar Collectorate; and the theory of Malabar tenure is that the land is held to belong to private individuals; and Government must prove their title to any land claimed on their behalf. The consequence is that the land claimed by Government consists of certain *escheats*. These *escheats* were formed after the rebellion of the Pychee Rajah, who was held to be the lord paramount of Wynaad.

It is an invidious task to rake up old subjects; and it would perhaps be held presumptuous on my part to criticise the action of the authorities in claiming these *escheats*; but I think I may venture to say that, at the time of the question of these *escheats*, forest land was held to be of far less importance than cultivated land. Thus, in looking over the old records, I have found that the *escheats* of cultivated land were carefully mentioned, while forest land is in most cases not mentioned at all. Most probably it was considered that the

forest land belonged without question to Government, since the defeat of the lord paramount of Wynaad.

However, so soon as coffee cultivation spread to Wynaad, natives took advantage of this silence, and claimed nearly the whole of the forest land not previously entered on by Government.

This is markedly shewn in the case of the Evergreen forest on the crest of the gháts; and Government possesses scarcely any forest land in South Wynaad. I do not propose, however, to go into the economical question of the present condition and value of the Wynaad forests; for this would be a long and wearisome subject. The great curse to Forestry here, as elsewhere, is the cultivation of grain by forest tribes, and by others in their name. Magnificent forest has, in a succession of years, given place to wretched gradations of coppice; and I can safely say that a forest officer is caused great conflict of mind between his desire to preserve the forest and yet not deal hardly with the natives.

The only remedy I can see is the system termed "cantonment" in French forest phraseology; that is, giving up a sufficient block to the tribes that have a right of cultivation in the forests: but nothing can be done without a detailed survey.

In this Presidency, unfortunately, I think for the interests of Forestry, one of the best "written-up" forests during its infancy of the Department was the Anamallay Forest in South Coimbatore. Here there is a well-defined race of regular hillmen, and their rights were jealously guarded. I use the word "unfortunately" above however, because I cannot help thinking that the orders passed for this and similar hill tracts have more or less influenced the whole of the legislation on the subject of Forest since. Thus hill tribes and forest tribes are used often as almost synonymous terms; and rights made for a small special tract are granted over the length and breadth of the Presidency. Thus it is that in Wynaad and elsewhere under the name of the forest tribes, Mysore merchants and Chetties practically derive a great deal of the produce of Ragi cultivation, and have a right to clear any amount of minor produce. A very small bribe is sufficient to induce a forest

man to declare that he sold the produce to the merchant. However, I am getting into debateable ground, so I had better paddle on.

Needless to say, there is plenty of water in Wynaad. The south-west monsoon, which sets in towards the latter end of May, or the beginning of June, is exceptionally heavy, and the rivers swell to inordinate proportions, and generally flood miles of country. At all times there is a certain amount of water in the main rivers. These main rivers are the Coilary river in North Wynaad, and the river generally known to Europeans as the Coodrapandy river in South Wynaad. These form the head waters of the grand river Cubbany, which flows through a large extent of the Mysore plateau. The Noogoo river, which rises on the Gháts in South Wynaad, forms a considerable affluent of the Cubbany, falling into it on the right bank near Humpapoor, about twenty miles from Mysore town.

The Nangur Holay, or the Tarcaun River, is a large stream which takes its rise in Coorg, and flows into the Cubbany on its left bank, some five miles east of Heggedavencotta, in the Mysore Province. The Cubbany itself flows into the Canvery, some forty miles above the famous falls.

About two years ago I was sitting at a convivial mess besides a gallant Colonel, an ardent and well-known sportsman, who looked the picture of an English squire, and bore no traces of Indian maladies—and I have to thank him for a happy phrase. In the course of conversation he said: "The fact is, there are some young fellows, now-a-days, who seem to find every place slow, who eke out their time with smoking and drinking, gaming and yawning; and are thankful when the day is over. Wherever I have been placed I have always found my days too short. If I cannot shoot, I fish; if I cannot fish, I shoot; and if I cannot fish or shoot, I ride. In fact I like always to *develop the resources of a country.*"

For many years numbers of sporting Englishmen had lived in Wynaad without attempting to develop the resources of the rivers, until a happy idea struck a friend of mine, a coffee planter, to buy a canoe which was advertised.

The canoe arrived in due course. It was made of zinc, and was about as crank and uncomfortable a craft as it has been my misfortune at any time to sit in. However, it served its purpose for a time, and gave us constant amusement. I remember at once of the early trials a stalwart and game, but inexperienced, cruiser took a step into the canoe as it was moored by the shelving bank, as if it were a barge; and it is needless to say that his next step was into deep water on the other side.

On another occasion a veteran planter, who had been for years the captain of a vessel before taking to planting, insisted on trying his skill, saying that he knew all about canoes, having repeatedly tried them in Siam. The occasion was a picnic, and the adventurer was dressed in his antediluvian best. I remember that the crowning adornment was a tall black hat, which he boasted had been present at the weddings of all his five daughters. He started boldly on his trip, but having been used to a single-bladed paddle, he was soon seen leaning well over to one side and working one blade frantically.

The canoe gradually heeled, till he was shot out into the middle of the river. He instantly appeared swimming like a man, but left the canoe to its fate, and went for his patriarchal hat. Having recovered this, he swam ashore; and the canoe went gracefully down the rapid current.

When the idea was once originated, however, a modest canoe club was quickly formed. I say modest, for our numbers were very few. We sent down to a cabinet-maker in Madras an order for two more zinc canoes to be built with rather a more open well, and larger altogether than the original canoe. Untried native talent did not produce very scientific lines; and the general appearance of the zinc canoes, when they were finished, would have driven an English boat-builder mad. However, they were steadier than the old canoe; and there were not quite so many upsets among beginners. It was always a difficult operation getting in and out of them, and one had to be constantly on the *qui vive* in navigating the river; for they required very little persuasion to "brick" you out.

There is always a day of small things with every enterprise ; and at first we were content with paddling about the pool immediately above the landing stage, and trying the small rapids above and below : then one or two trips were taken up stream, and other trips were taken in emulation, until we knew the river to within seven or eight miles of its source.

One of the most interesting points to my mind was to notice the different gradations of vegetation. Around Manantoddy itself there is little or no forest. The chief features in the scenery are rolling grass hills sparsely dotted with trees. However, there is a great curse which must be mentioned, as it forms decidedly a marked characteristic of the scenery about this part of Wynaad. This curse is the *Lantana*, which overruns every acre of unoccupied ground that has once been under cultivation on these hills. It grows so densely that neither men nor cattle can get through it ; but it affords boundless cover for panthers, which are in consequence very numerous, as many a lover of dogs knows to his cost, and which make considerable havoc among cattle.

It is said that the *Lantana* was introduced by some botanist as a garden plant. Its verbena-like blossom is certainly pretty ; and in some parts there are wonderful varieties of colour, the prevailing tint, however, being orange. The leaves have a strong smell when bruised, very similar to that of black currant leaves. I have heard that Rs. 500 were once sanctioned for the extermination of this pest. As well try and stem a flood with a yard of paling.

The only way to get rid of the *Lantana* on any particular piece of land is to dig it up and burn it—root and branch ; and reappearing sprigs have to be annihilated in the same way time after time.

It is held by many that the *Lantana* is not an unmitigated curse, but that it tends to renovate the soil in a marked degree, owing to the denseness of its cover.

To return to our canoe and paddle up-stream after this excursion on the banks. It is very noticeable as one gets nearer to the ghâts, how the deciduous forest disappears and gives place entirely to Evergreen Forest, that is to say, Teak, Black-

wood (*Dalbergia latifolia*), Mutty (*Terminalia tomentosa*, one of our commonest trees), Benteak (*Lagerstræmia macrocarpa*), Honay (*Pterocarpus dalbergioides*, the gum kino tree), and other ordinary deciduous trees give place to Poon (*Dillenia*), White Cedar (*Melia indica*), Red Cedar (*Acrocarpus fraxinifolius*), several kinds of Meliaceæ, Ironwoods, Garcinias, and the numerous kinds of ordinary evergreen trees.

This however verges on "shop," and it were better perhaps to describe one or two incidents of canoeing experience. A planter friend, D—by name, and I, were among the earliest to tire of petty trips; and proposed, after we had had the new zinc canoes for a week or so, to go a long cruise down the river. The canoes were rather crank, we were rather new to the work of navigating rickety boats down risky rivers, and the dangers of the course were unknown; so we made up our minds to expect an upset sooner or later, and therefore started with our trousers tucked up, without shoes and socks, and otherwise prepared for swimming. I mention this, for thereby hangs a tale.

We took tiffin with us, and intended to go from Manantoddy (the head quarters), to a place called Padry, whither we despatched our luggage by road. I have before mentioned that there are two chief feeders of the river Cubbany—the Coilary river (on which we started), and the Coodrapandy river. These two main streams joined about two-thirds of the distance from our proposed destination, and thenceforward we fondly imagined would flow in one grand volume. Let the event speak for itself.

We started then, on a pleasant morning, prepared for mishaps, but without a misgiving. We expected to have to meet our difficulties in the Coilary river, if at all, that is, above the junction referred to with the Coodrapandy. As we progressed, therefore, now round one bend, disclosing a magnificent reach of calm water, then down a swift but perfectly feasible run, then coming to a reach again, with no difficulties, but a few easily avoided rocks, we congratulated ourselves that we had over-estimated the probable risks. How we enjoyed that morning! There is a wonderful charm in

novelty itself. We paddled lazily down, enjoying every change of the changing scene.

How was it possible to have lived so long within reach of this new phase of sport, and yet never have tried it? We voted our friend who first started the idea, as a public benefactor. There seemed so few real difficulties that our great fear was lest we should reach our destination too soon. We therefore loitered somewhat at "Egg Point." To the uninitiated I may mention that in all our cruises we carried a certain number of eggs, hard-boiled, which gave us a most portable and get-at-able snack between early tea and late tiffin. We went quietly down stream again, and as both of us anticipating an upset had left our watches behind, we did not know how time was going on. At last, however, we reached the junction of the two streams, and here we had our regular tiffin and wasted much time. All our difficulties, we thought, were then over, but alas! they were about to begin.

The first foretaste was a very heavy rain storm, which made everything sufficiently uncomfortable. We were, however, provided with waterproof coats. The rain was hardly over when we started again on our journey, and found, to our dismay, on turning the second or third bend of the river that instead of flowing, as we had expected, in one grand volume, the river suddenly split up into two or three channels. We were in a fast run, and had rapidly to make our choice of the several almost equally unpromising looking courses. We soon found ourselves in unmistakable and most unpleasant rapids. The stream kept on subdividing, and we saw that our course lay among a net-work of islands separated by rushing, foaming channels.

In many places we were forced to get out and wade, and drag our canoes. Oh! the miserable contrast between dragging your canoe and being carried by it. How helpless is an unbooted European in trying to wade a rocky stream: and how thoroughly wet one gets in trying to keep dry. After varied experiences we came to one very bad rapid. The water was tearing down like a mill race, and all was foam as far as we could see. Taking advantage of a slight backwater near the shore, we were glad to get out from our canoes to prospect. We

pulled our canoes up partly out of the water, and had gone a short way, when my friend, who had been gazing up at the cloudy sky, startled me by saying :—" We have no time to lose, but must camp where we are." I had not dreamt of the lapse of time; but when the matter was brought to my notice, I saw that there was no course open but to assent at once, for we had very little daylight left. We rushed back and carried up our canoes to the highest ground at hand; for we were on a "dissolute" island, as we knew, with many a foaming current between us and the mainland, and a sudden fresh might have carried off our canoes. My friend had graduated in the colonies, that is to say, he had tried Australia for some years as a very young man, and his "Bush" experience came most happily to the front on this occasion. He took the command at once. It was now getting dark rapidly, so he said :—" Let us look out at once for a camp." We went a little further from the river, and found one that would do. "Now" was the next order "we want firewood. It is no use both of us wandering away, or we shall never find each other or the camp. One must fetch firewood, and one must stop in camp, and cut it up: I noticed some dry wood, as we were carrying up our canoes."

And sure enough, he returned shortly after dragging a large branch of dead wood, and went away saying he had noticed some more on our way to choose a camp." It was now quite dark, and if it had not been for my friend's camping-out qualities, we should have spent a miserable night indeed. I never thought about firewood, and could not possibly have found it in the dark, except by the merest chance. I set to work and cut up the wood with a shikar knife as well as I could.

We then set to work and built up a fire, or rather my companion did. I never met his equal at making a fire. We soon had a roaring blaze, although the wood had been wetted by the storm, and then proceeded to get our dinner. This consisted of the remains of our tiffin, and was as follows :—

One half a loaf of bread.
One small tin of sardines.
One bottle of soda water.

One flask of brandy.

Plenty of cheroots.

We were both hot and tired, and drank the soda water plain at once. I never knew before that half a plain soda could be so invigorating. During our whole camp preparations we had known the limited contents of our larder, but had consoled ourselves with the assurance that the oil in the sardine tin would make our stale bread palatable. Imagine then our disgust on opening the sardine tin to find that, for some unaccountable reason, there was not a drop of oil in it. However the sardines were quite good; but we found that our appetites were not vigorous; for we were able to leave part of the bread and some sardines for *chota haziri* in the morning. We had a good stiff tot of grog, and a cheroot or two; and I then disposed my gun, loaded under my head, for the jungle looked tigerish, and went to sleep. At the risk of an upset I could not make up my mind to leave my gun behind, and it certainly afforded us comfort that night. I had a thick double Mackintosh with me, and although our clothes were wet, and the ground was damp, I felt perfectly warm, and slept like a top. We had some arrangement about relieving guard, to keep the fire going; but my friend did not wake me. I am afraid he had a wretched night, not from cold, for he had a thick jhool with him; but he was rather feverish and could not sleep. He dozed off a little towards the morning, and I kept the fire going then, having had a thoroughly good night's rest. About 5 o'clock we finished the remainder of our unappetising viands, and went to have a look at our course. We found that it was lucky we had stopped; for we should have been upset had we tried to go down stream. There was a fall of some 3 feet, and a bed of broken rocks beyond it. This does not sound very awful. It was not so wide as Niagara, nor so deep as the Maelstrom: but "it would do, it would suffice." There was nothing for it, but to carry our boats, and put them in below the fall. This entailed carrying for a quarter of a mile; and, as we were scarcely "fit," we found the process of carrying most break-back work. We had to make three trips backwards and forwards, one with each

canoe, and one with the kit. We got on well enough for some little time, when we came to some rapids that we thought it more prudent to avoid by towing our boats.

Our towing gear was rather primitive; mine consisted of a belt, and my friend of a bathing towel. After laboriously toiling in guiding our canoes down the rushing rapids, I got so tired of the process that I steadied my canoe in a back eddy, and got into her determining to risk anything rather than struggle any longer. I was just turning round to tell my companion of my determination, when I heard a shout of horror from him; and had time to see a tableau. He was standing bare-footed on a sharp jointed rock pulling "like grim death" at one end of his bathing towel, while his canoe had swung broadside, on down a rapid that was too strong for him to hold his own against. Just as I looked round he let go his hold, and his canoe hurried away. Here was a nice predicament. He was still on the island, without socks or boots, his only hope of transport gone. Of course, even if I had not intended to risk the rest of the rapids, there was only one course open, namely, at all hazards to catch the runaway canoe. I struck out therefore vigorously with the paddle, but to no avail, and finally discovered that I was hard and fast on a rock. I had to get out and move my canoe before I could get her afloat; and all this time the runaway was making the running. However by the help of my paddle I made up the distance; and then saw that I could do nothing to stop the other canoe until we got to the end of that series of rapids; for I should have been upset had I tried to hamper myself with another boat, and as it was, it was only a question of a stroke at the right time between safety and a cold clammy watery grave. I therefore passed the runaway canoe, the course of which had been impeded two or three times by obstacles, and caught it at the bottom of the rapids. The water was running so fast here, however, that it was some time before I could land my prize. I then began shouting, but for a long time there was no response; until at last there reached my ears a far-away

hulloa. After some time, by the help of guiding skouts, my friend appeared picking his way painfully through the thorny jungle, bare-footed as he was. He told me that his feelings were not easy to depict when I disappeared in chase of his canoe. He thought that I should most probably be upset; and that the chances were decidedly in favour of the stream in that event; and then two masterless boats would be found by unsympathizing and uninquiring natives, while I had disappeared, and he would probably be starved before he could get to the mainland. Swimming across such rapids was out of the question. It is easy to imagine his delight than at hearing the first distant cry. His course was a painful one, but he was too much relieved in mind to care about such minor considerations.

After this, we reached our destination, Padry, without any mishap. However the results of the trip were still to make themselves felt. Neither of us had fever, but we both suffered agony from our blistered shins. I mentioned before that we had kept our trousers tucked up all the way to be prepared for swimming; our canoes had open wells, and the consequence was, that the blazing sun blistered our legs most fearfully. I did not get over the scorching for months. Never so long, as I live in this country will I bare my legs again to a long continuance of sun.

On our return, after I had finished my work, we gave an outline of our adventures, which were received rather incredulously as regards the real nature of the difficulties we had met with. We frankly admitted that many of the difficulties were of our own making; and that on the second day we shot rapids that we should have shirked on the first; but even with all these admissions, we said that there were some undeniably bad places, and that from the junction of the two feeders the course was so decidedly risky that we neither of us felt inclined to try it again. Our confident Secretary looked it over on the map; and said, "Why, I would go down and back again in a day, starting early." Our only reply was, "Do it." However no one else ever did do it. As for going back, I offered to eat my own hat, and those of all the

club, if any one would go hundred yards up stream, allowing us to place his canoe where we liked at six places in the course. I had not an opportunity of trying this gastronomic feat.

It must not be forgotten, however, that in these rivers liable to sudden floods from monsoon rains, and to equally sudden falls, the same stretch of river may be practicable one day and impracticable the next. The portion of the river that was the scene of our adventures could not, nevertheless, be ascended at any time of the year, without frequent postages, for the descent is too rapid.

I will give shortly another experience. During the depth of the monsoon I was going out for work from Manantoddy. My first stage was a place called Pannamaram, which is, by interpretation, the palmyra tree. Being a short stage I started rather late in the day; and my horse had just been ferried across the river at Manantoddy, about 12 o'clock, when I came down to the bank. The river was full to the top of the bank, and I could not resist a sudden impulse to try my chances of reaching my destination by water on that glorious flood. This I knew would entail great labour; for I had to go down to the junction of the two streams which I have previously mentioned, and then some miles up stream to Pannamaram, up the Coodrapandy branch. That is to say, I knew I had for a good part of my journey to face the full current of a monsoon flood. I thought the slashing downward journey would, however, compensate me for the after struggle. I therefore sent on my horse and started by canoe. It was raining of course. In a Wynaad monsoon one gets accustomed to riding or walking in the rain, as if such a thing was not; of course a waterproof is indispensable. The downward journey was wonderfully exhilarating. I should be afraid to try and calculate the pace that a canoe steadily propelled (for I used my paddles as I knew I was late), went down that tearing, swirling, roaring flood. One thing I know, and that was, that I did the distance to the junction of the streams in a little over an hour and a half; and the same distance had taken me six hours' steady paddling in the slack water before the monsoon. It was then about a quarter-to-two in the after-

noon when I commenced my journey up the Coodrapandy stream towards Pannamaram. "Oh! then began the anguish of my soul." Inch for inch, foot for foot, it was one continued struggle: for the river was so full that even the back eddies were only distinguishable by requiring rather less tension to toil against them. In rounding corners I struggled sometimes for two and three minutes together, not making one foot of way, till a more vigorous effort, or a slight change in the swirling eddies would enable me to get out of the full force of the stream. After about an hour of this work, I stopped and eat a few biscuits I had with me, drank some brandy out of a small flask, and resumed the struggle. To make a long story short, night fell, and found me still creeping up the flood. However, it became so pitch dark, and there was such a roar of waters ahead that I determined at last that I was "in for it," and must camp out. Moreover, I could not get over the impression that I must have passed Pannamaram in the dark, at a point where I had heard some natives calling out to one another. With this idea I turned my canoe, and let it run down the tearing current. I had gone about half a mile when I heard a rush in front of me, and just had time to give one vigorous stroke away from shore, when a branch of a submerged tree caught me in the stomach and nearly swept me into the river. Luckily, the branch was rotten and broke off. I had had enough warning however, and determined to make for shore. I clung on to a bush by the shore, struck a match, and found that it was a little past 8 o'clock. It was then that I found that it was not so easy to reach the now-desired haven. The water of the river was high up among the trees that line the banks, and in the pitch darkness, I could find no way through them. So soon as I had pushed my boat among them, the current bore me in among the branches, and I could move neither one way nor the other. In some ventures I was terribly scratched by thorns, and more than once nearly upset. At last, however, I got through, and drew up my canoe on a slimy bank. On looking at my watch I found that it had taken me over a full hour making my haven of refuge; for it was about a quarter past 9 o'clock now. I had

nothing to eat or drink, and my cheroots were so wet that they bent double; so I coiled myself up in the boat, covered with my waterproof, and went to sleep almost instantly. I slept till about 4 o'clock, when I was startled by the cry of some jackals near me; and not knowing whether they might not take me for a corpse, I pushed the canoe into the water, and waited for day light. At 5 o'clock I toiled again up stream, and made Pannamaram at about 7 o'clock. I suffered no ill effects from this trip.

One more cruise. In August 1876, I had occasion to go to Mysore town to look after our timber depôt there; for permission had unwillingly been granted us to establish one there. I thought of going by water, and again sounded my friend and found him "ready, ay, ready" for another cruise.

This time, however, we both agreed to avoid the scene of our former disasters; for although adventurous spirits, who had not tried the course, might make light of the difficulties, we had a vivid recollection of them, and a wholesome respect for that particular stretch of river; and, what was more to the point, a rooted determination never to be caught on it again.

We therefore fixed upon a place called Carcancotta as our starting point. This was a few miles further down the river than Padry, the point of debarkation of our last trip, and was below the network of islands that wrought our woe.

My canoe was one of the old zinc flotilla; but we had gone a step forward since our last voyage, and my companion had a cedar canoe built by Searle. This was a present to the club from a member on his leaving the district. This canoe had very good lines, and was very steady as well as fast. My canoe was one of the old ricketty muster, but I had had a good deal of practice since the last cruise. Our experience of the night, on what we had named "Short Commons Island," made us determined to take at least two days' provisions with us in future, and on the present trip we rather overdid the commissariat. Our dispositions were made as follows:—Our destination was Mysore town, to which there was a high road from Carcancotta, the stages being Antersunter, Humpapoor, and Mysore. Now the river, of course, wound considerably in comparison with the

road; but it nearly approached the road at Humpapoor. We were therefore able to count on coming up with our heavy baggage at Humpapoor. The distance by river from Carcancotta to Humpapoor we estimated at from 65 to 70 miles, or two days' journey down stream; we therefore fixed upon a half way camp on the river at a place called Surgoor.

On the morning of our start then we sent our horses and heavy baggage by the main road to Humpapoor; sent a peon and four coolies with a flying kit and provisions for two days (to allow for accidents) across country to Surgoor; and we ourselves started by river for the same place. As a precautionary measure we carried in our canoes what we thought would effectually prevent a repetition of the fare of "Short Commons Island."

The list of stowage of our canoes was amusingly extravagant, as an estimate for a possible want of supplies for two days.

Counting the stowage of both canoes the list was as follows:—

One bottle whisky; $\frac{3}{4}$ bottle brandy; 1 bottle champagne; 2 bottles beer; 4 tins of soup; 1 salt leg of mutton; $\frac{1}{2}$ a ham; 1 tin of sardines; 1 tin of potted meat; 12 hard-boiled eggs; $\frac{3}{4}$ roast leg of mutton; 2 loaves of bread; 1 tin of biscuits; tea, coffee and sugar; quinine and chlorodyne; tobacco; 3 tobacco pipes; cheroots; 4 boxes of matches; 2 tins of butter; condiments; 1 cooking pot; 1 tea-pot; 2 tea cups and saucers; 2 mugs; 4 plates; 2 dishes; 2 knives, forks and spoons; corkscrews; tin-cutters; 1 change of clothes each; soap, towels, &c.; combs, &c.; 1 hatchet; 1 shikar knife; 2 large pocket-knives; 1 spare paddle; 2 double-barrelled No. 12 smooth bores, with 60 rounds of assorted ammunition; 2 waterproofs; boat-cushions; 2 tow ropes; Trigonometrical maps; 1 pocket-compass; Rs. 50 in cash; and the journal of a voyage down the river in a punt by two adventurers from Wynaad some years before, accompanied by 3 coolies and a dog.

This cargo slightly overloaded the canoes, especially the zinc one, as the beam of this was only 2 feet, whereas the beam of the wooden one was 2 feet 4 inches. However both canoes were perfectly manageable; and although they slipped a little

water when driven through lumpy rapids, they were buoyant enough when left to the current in such places, being guided by backing water, instead of by a propelling stroke. Our first journey, of some 30 to 35 miles to Surgoor, we accomplished without mishap, the river presenting no unusual obstacles, although diversified by rapids. Half-way we camped for tiffin. Now our tiffin was a matter of much forethought. In Europe I frequently went on walking-tours during the holidays and vacations, and repeatedly with a tried companion. I well remember the serious way in which we discussed our first journey. We thought it best to state no definite time for the length of our journey, but to go on like Mr. Jorrock and the Yorkshireman, so long as the money lasted, leaving of course a margin for our expenses home. On one point, however, we were both agreed, namely, that no consideration whatever should stand in the way of our having a thoroughly good dinner. We would economise in every point but that of our food; and I firmly believe we were right, and that it is the wisest policy, when hard exercise day after day enters into the programme, to keep the vital energies up by all the means in one's power; and that a fortnight's tour on stalled ox is better than a three weeks' tour on dinners of herbs.

On this our canoe journey then we determined that our tiffin should be a good one; and we found the following not altogether bad:—Take two tins of soup, one thick and the other clear, add one tin of water, and boil all together. This was a very fair commencement for tiffin even for two men in hard exercise; and ham, sardines, eggs, &c., we took as our appetite might demand, drinking 'as an accompaniment one bottle of champagne between us. That is my idea of roughing it in the East. Some men, generally very young men, think that roughing it unnecessarily in earnest constitutes a great element of sport.

I remember once coming across a subaltern at a small bungalow in the jungles, who was out "roughing it" on a solitary shooting expedition. He was seated on a rickety old bungalow stool, with a newspaper spread on the table by way of table-cloth and plate. In the centre of the table was the leg

of an antelope he had shot, and he was carving hunks out of it with his shikar knife; having no other knife, and no such luxury as a fork or spoon or plate. Possibly he might extract some pleasure from this Spartan self-denial. There is no accounting for tastes.

Pardon me one more digression. I talked of boiling our soup. Now this operation is easier said than done. As I remarked before, my friend was a wonderful hand at making fires; so luckily the difficulty was got over much to my satisfaction. He seemed to have an instinct, or perhaps it was rather a result of colonial experience, as regards the choice of a camp. More than once I drew my canoe near the bank, and pointed out what I considered a good camping-place. Often he would come and look, and conclude, "can't make a fire there," and on we used to move. On one occasion, however, I was obstinate. There was a beautiful spot, and what looked to me plenty of firewood about; but my friend insisted that it would not burn. However, he gave in to me, and the result proved how true had been his anticipations; for the wood would do nothing but emit smoke; and an inordinate amount of time was wasted in preparing tiffin.

Our journey was diversified by teal shooting; and although our bag was not a large one, yet we got quite enough for our wants. The birds were not numerous, but sufficiently so to give us pleasant sport. One thing materially diminished the chances of a big bag; for, although my friend's wooden canoe was steady enough for all shooting purposes, my zinc canoe had a nasty knack of upsetting if one fired sideways from it, as I had before proved by experience. I had, therefore, in every case to get my canoe end on before I fired, and consequently lost many a shot at teal.

We camped in a ruined old cutcherry at Surgoor, finding our coolies in before us; and passed a comfortable night. The native Amildar thought we were a little mad I think; and wondered what fun we could find in going down the river without coolies to paddle for us. In fact our experience was that the natives generally thought very little of our small boats. One old fellow during the course of this voyage, who was

helping us to carry our canoes across a dam, referred to the trip taken by the two men in a punt, that I have above mentioned. He said he remembered them passing; "but," he he added in a most disparaging manner, "*they* had a big boat, and had coolies with them." So if any one wishes for honour in this country, by all means let him go in a flat-bottomed punt with slaves to paddle for him.

Our second day's journey was equally propitious; and we came up with our heavy baggage and servants at Humpapoor.

Here we stopped a day to give every one rest, as the roads had been very heavy for carts; and we shot duck on the tanks.

We then despatched our carts for Mysore early on the morning of the 30th August; and started ourselves for our last day's journey to a place called Nunjangode. The Cubbany river does not flow near the town of Mysore. At Humpapoor the river is some 16 to 20 miles from Mysore, and it then flows eastwards to Nunjangode, which is also some 16 miles from Mysore. The distance by river from Humpapoor to Nunjangode we calculated at about 30 miles.

This was to be our last day; and a somewhat eventful day it was to us. In the first place, we had been misinformed about the bungalow at Nunjangode.

There is a bungalow belonging to the Mysore Commission. We had been warned before starting by a friend to write and ask permission to use this bungalow, and had intended so to do. However both at Carcancotta and at Surgoor, we had been confidently informed by the natives at the bungalows that this building had been turned into a public bungalow, and, therefore, no permission was required. Trusting to this, we did not send any flying kit across country; for Mysore public bungalows are generally very good and well-provided.

We started early in the morning from Humpapoor, and got on pretty well, until tiffin time, when we had the difficulty about the fire I have before adverted to. After this our luck forsook us. We found the water getting very shallow and rapid; and the bed of the stream was becoming more and more rocky. We were, however, rather careless about what we

should at first have considered dangerous ; and omitted some of our usual precautions. My friend was short-sighted ; and was, therefore, very much handicapped in steering a course through short rapids. Whenever consequently we came to nasty water, I went first, and he followed in my course.

However this fateful afternoon we were, as I said, careless, and neglected this precaution.

We were going at a tremendous pace down some very rocky runs, and I noticed a little way ahead of me a particularly bad place, where there were two rocks to pass between, with a rock on one side a little higher up the stream. I saw that there was a strong cross current running by this upper rock, which would probably force a canoe on to the left one of the lower rocks, so I steered out into the middle of the stream, and avoided "the whole concern." I did not shout out, for my friend was some way behind, though not following my course exactly : and I thought he would notice my movement out into mid-stream. However, a few seconds after, I heard a crash and a shout, and looked round to see his canoe jammed hard and fast by the cross-current on to the lower rocks. It was some little time before he could get his boat off at all, and then he made for the bank ; but nearly sank before reaching it. I had my canoe turned, but could barely force my way up against the current. As soon as my friend was ashore, we examined the damage. There was a fearful hole in the side of his canoe, almost big enough to put one's fist in. This was pleasant. We were an unknown distance from Nunjangode, in an unknown country. My friend was so disgusted at first that he was inclined to throw his canoe into the river, and walk to Nunjangode or Hong-Kong. However, on consideration we agreed that the best thing to do was to try and mend the yawning gap. But how ? We had talked about the possibility of staving a hole in a canoe ; but had never thought of the probability of its happening to us. I had with me a few, a very few tacks, and a pair of pliers. These I produced. On further consideration my friend produced a small deal box, which he had brought to keep the provisions together in his canoe ; and I proceeded to extract all the nails

from this box. We then cut some strips off a waterproof coat, put three or four pieces one over the other, and nailed them as well as we could over the hole. We then took half a loaf of bread, kneaded it in water, and plugged up the inside of the hole; over this again inside we placed a piece of the deal box.

When all was finished we started again, and after a few minutes my friend turned to me with a startled cry of "I'm not shipping any water." There was a silence again, as we were still among some bad rapids; and then the astonished voice exclaimed again:—"I'm not shipping any water." We had three hours in the water after that, parts being very full of rapids, yet we reached Nunjangode in safety. Of course some little water eventually leaked in; but hardly more than got into my canoe. The last run just before Nunjangode is very rocky, and we both nearly came to grief in shooting through the tearing current under the arches of the bridge. You can picture the difficulty from the following description of the bridge from *Thornton's Gazetteer*:—

"The Cubbany is here crossed by a bridge, which is looked upon as a prodigy of grandeur; but which in Europe would be considered a disgrace to the architect of the meanest town. The arches are about five feet span; the piers are of nearly an equal thickness, and do not present an angle to the stream," &c.

It is a very long bridge, over 200 yards, I believe. It was "touch and go," getting our canoes safely end on through these narrow arches.

However, our difficulties were not yet ended. We pulled up at the Bungalow below the bridge, and found that it was not a public Bungalow. We heard too that the Duke of Buckingham had been stopping there, and had left only just before our arrival. The man at the Bungalow would not let in a pair of loafers like ourselves, sunburnt, and wet, and dirty, without servants or peons or anything to certify to our characters; and he was of course perfectly right. After expending some useless anathemas we went down-stream to the town, situated about a mile and a half further down stream. Here we tried to make ourselves understood, but every one had

gone mad with the Duke's visit, and no one would listen to us. What we wanted were bullock-bandies to take us to Mysore. The language chiefly spoken was Canarese; and I knew hardly a word of Canarese, and could find very few Tamil-speaking natives. My friend spoke Canarese of sorts, but could get no information about carts. He went on downstream using certain British expletives at every fresh failure; and I followed him, and followed suit. At last I found a Tamil-speaking native who only half caught what I said as I steadied my boat in the stream, and took a drink. However, his eyes suddenly sparkled with intelligence, and he said, "Brandy, Brandy, I don't drink Brandy," or without waiting for any further explanation said to some coolies, "Here this Sahib wants you to carry his boat, and he will give you some Brandy." I poured obloquy on him, and at last made him understand; when he replied just as an Englishman would say at home:—"Sorry to say I am a stranger in these parts," I gave him up as useless; and steered further down till I came to the large steps of a temple. Here I found a Tamil-speaking policeman who was excessively polite, and said he would get us carts as soon as possible. I, therefore, set off to recall my friend, who was now nearly frantic with rage. He had moored his boat and had gone on a tour of discovery, and I heard "winged words" flying about in the distance. He came back exclaiming, "Everyone has gone stark, staring mad with the Duke's visit and the tamasha:" and so they had; for they were all hurrying along like lunatics.

We were thankful to have found our polite policeman. Alas! for human gratitude. I took his number in the fulness of my heart, and lost it. In fact so soon as I had got back to comfort, I remembered no more my policeman, but forgot him. However, it turned out a more difficult thing than our ally had thought to get carts, for the bandymen had all gone mad too. Our provisions were all more or less sodden, so we gave the ham to a pariah dog, and he carried it off. It was nearly as big as himself. The rest of our wet viands we similarly disposed of; and then sat down to dinner on one of the steps, off biscuits or a cold tin.

Altogether we had to wait from 6 o'clock till past 9, in anxious expectation of the arrival of the carts. At last they came. We packed the canoes in two carts, and went thankfully away to Mysore in the third, leaving a *douceur* with our polite policeman.

Thus ended our cruise. I have avoided descriptions of scenery as much as possible; but I may add that the change of scenery, day after day, was most remarkable. About Carcancotta there was the high teak forest, and this gradually gave place to the growths found on the Mysore plain. I have before mentioned in the list of our stores that we had the log of a cruise by two previous wanderers in a punt. They took a fortnight to do the journey which took us only three days of actual travelling; but being accompanied by coolies, they were able to get over the difficulty of rapids without much personal exertion. I was told by the writer of the log that it was at first written with the intention of publishing it in the *Field*. The British public lost something; for the "tall" passages were very tall. The writer assured me that it had been a matter of consideration at first whether some real shikar adventures that had happened to the parties should not be introduced. The stories were to be true; but the connection made to suit the trip. This, however, was overruled; but the author could not resist some slight indulgence of his imagination. I remember a description of a night at Carcancotta, which amused us very much, as we read the log on one of our evenings out. There is game of all kinds in the Carcancotta jungles; but the way the animals appear in the narrative reminded us of the old song:—"The animals came in one by one, hurrah!" &c. Sambur belled, tigers roared, panthers flitted past like ghosts in the moonlight; at intervals was heard "the splash of the lonely alligator;" why lonely? and the description of the elephant's trumpeting was sublime. It ran somewhat thus:—"In the distance was heard the shrill scream of the elephant, dying away like a growl of thunder." However, having worked up to the elephant the writer ended his zoological description with the croaking of the frog, a fearful bathos. I remember

another description in this log of a beautiful part of the river above a large anicut or dam, where the author dilates on the magnificent dimensions of the dammed up sheet of water "large enough for all the boat-racers of the world to be rowed on:" and then describes "the beautiful appearance of the banks bordered with date palms, with their feathery heads and drooping fringes;" and then bursts into eloquence with the refrain:—"By such a pathway, only bathed in a radiance softer than moonlight, we can imagine the good king Arthur, of our mystic legendary, wafted to his home in fairy land." I quote from memory: but as I cannot produce anything of my own to beat that I will attempt no descriptions.

In conclusion, I may give one or two hints about canoeing from my later experience. I have now a splendidly built canoe, by Biffen & Co., of Bedford; and can confidently recommend the firm for honest work. It was built to order, 16 feet by 29½ inches width. This is larger than the ordinary run of cruising canoes I believe; but I think it a great mistake in this country having one's stowage room too limited; and one wants to shoot at any angle with comfort. I have had many a cruise on the Cauvery and Bhavani rivers, and found the canoe answer to perfection. So far as stores are concerned, the kind and quantity must be a matter of taste. In order to ensure comfort on a cruise, however, a locker in the stern is indispensable, instead of having the deck in one piece as in an ordinary Rob Roy. Having learnt by former experience, I always go prepared for a smash; and for the purpose of mending possible holes I carry:—

(i) Five or six pieces of sheet copper of different lengths and widths, *with holes ready bored* all round to admit nails or screws.

(ii) A sufficient supply of brass screws, and copper nails; screws to be used for preference.

(iii) A supply of white lead and putty for caulking.

(iv) A portable leather case with all useful tools.

Other necessary parts of an outfit are:—

(i) A tow rope, a little more than 1½ times the length of the canoe. It is most conveniently carried thus:—One

end of the rope is knotted, the other end is run through a hole at the top of the stern; the rope is drawn right through the hole as far as the knot. The rope is then laid along the whole of one side of the boat, the end run through a hole forward, and the rope is then brought round the other side of the boat to a convenient distance near the paddler's hand: so that it can be seized at any moment.

(ii.) Ballast tins for sailing. I have two block tin canisters made to fit into the bottom of the canoe between the mast and the stretcher. Each contains about nine bottles water. I prefer water ballast, as one can empty the tins when ballast is not required; and they are not a dead weight if the boat should half fill with water from any cause.

(iii.) Portable wheels and axle, made so as to fit at the bottom of the locker. I copied the design of these out of Baden Powell's book on canoeing.

(iv.) A lee board, copied out of the same book.

(v.) A sponge for baling, indispensable.

(vi.) A rest for a gun, of my own device: consists of a block of wood fitted on the fore part of the well to receive the lower end of the barrels, and a block stepped into the mast-hole to receive the upper end of the barrels. The gun thus lies on the top of the deck; and is in a most handy position; Of course the gun has to be stowed below when sailing.

(vii.) A row lock on each side fitted aft of the paddler to hold the paddle for steering purposes when sailing. I have a rudder, but never use it.

This paper has already reached too great dimensions to admit of my giving any incidents of later experience.

I write simply in the hope of throwing light on a new field of sport peculiarly suited to the custodians "Des Eaux et Forêts"

To those who care not for sport, I have no word to add; to those who do, I would conclude:—

"Would'st thou, so the helmsman answered,
Learn the secret of the sea?
Only they who brave its dangers
Comprehend its mystery!"

A. W. P.